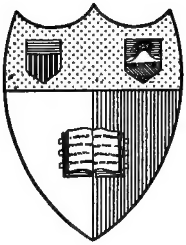

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DEPRECIATION

PRINCIPLES AND APPLICATIONS

By

EARL A. SALIERS, PH.D.

Assistant Professor of Accounting in Yale University

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PREFACE

Since the publication of the writer's earlier work, "Principles of Depreciation," in 1915, much has occurred, including the enactment of the federal income tax law, to make the depreciation question a problem of every-day business expediency. But, just as previously business men refused to write off any depreciation whatever, so they now have in many instances swung to the other extreme of advocating rates of depreciation higher than conservative authorities would care to sanction. Moreover, while there has been a growing realization that depreciation is an operating expense, practice in too many instances still fails to conform with principles. Corporations, for example, still continue to vary depreciation charges with their earnings, and bankers still persist in deducting depreciation from net profit in their advertisements of security issues. All this is evidence that there is still a great need for further enlightenment on the subject of depreciation.

In the past seven years a great amount of experience data has been accumulated which sheds further light on the subject. The mathematical and other formulas have not changed, but the field to which they apply has changed markedly. The purpose of this book is to summarize and interpret this new material in reference, first, to the general accounting principles differentiating between capital and income, second, to the federal income tax, and, third, to the valuation of public utility properties. Such special problems as "obsolescence" and "inadequacy," which from the financial point of view have not yet been fully considered even as academic questions, are given particular attention. These changes have made necessary the reconstruction and broad expansion of the earlier work.

In writing the book the author has kept constantly in mind the needs of all who have to deal practically with the depreciation question in one or more of its aspects. He has endeavored to meet the requirements of professional accountants, engineers, and lawyers, as well as corporate officials concerned with the financial and physical problem of maintenance and repairs. Without neglecting the underlying principles of depreciation, he has laid stress on the correct procedure in the practical application of these principles.

EARL A. SALIERS

New York City
October 1, 1922

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DEPRECIATION

PRINCIPLES AND APPLICATIONS

PART I

GENERAL PRINCIPLES

CHAPTER I

DEPRECIATION A FINANCIAL AND ACCOUNTING PROBLEM

Depreciation Incident to Industry

Most kinds of wealth depreciate for one cause or another. Land, however, does not usually depreciate and this and certain other kinds of property sometimes grow more valuable owing to scarcity, impossibility of duplication, or other causes. Yet these are exceptions to the tendency of most forms of material wealth to depreciate. With the exception of land, but a very small percentage of wealth extant in 1800 is still intact and useful. What physical deterioration has not destroyed, changing fashions and conditions and the progress of invention have rendered obsolete or inadequate.

The expansion of industrialism has not altered the physical aspects of the depreciation problem as greatly as it has its financial aspects. It has become an important phase of the fundamental question of the just distribution of wealth. Investments must be safeguarded, producers of useful commodities and services rewarded, and the industrial system stabilized. The extent to which these important things are dependent for solution upon a correct understanding of depreciation is not yet adequately understood. The credit system renders all industries interdependent. The policies adopted by one concern affect business and investments outside its own immediate circle.

Corporate Control of Wealth

A great part of the world's wealth is removed beyond the direct control of its owners. Even the possibility of transferring one's wealth to other fields, although simple in theory, is in practice frequently made difficult and sometimes impossible. The ordinary investor in bonds or stocks must trust to a great extent to the wisdom and honesty of corporation officials. Our various funded institutions cannot survive in perpetuity unless their wealth can be preserved intact while being made to earn a fair stipend. National boundary lines are not the boundary lines of finance, and frequently subjects of many nations are stockholders of one corporation. This concentrates wealth most effectively, but it also brings up for solution certain questions which under a simpler industrial régime were little thought about.

Capital and Income

The preservation of wealth cannot be intelligently accomplished unless principal and income are clearly distinguished. Upon such correct distinction depends the welfare of all parties interested in the success of industry and commerce. No enterprise can continue to prosper unless the substance of its wealth is preserved and at the same time made to produce additional wealth. This necessitates the adoption of accounting procedure adequate to separate capital from income. There are several reasons for this, each in itself sufficient to justify the trouble incident to the undertaking. We may consider briefly the interests of the consumer, the investor, the business man, and the State.

The Consumer

All persons are consumers. In the popular mind the interests of producer and consumer are frequently in apparent conflict; in reality this is a fallacy, for, broadly speaking, consumers and producers are identical. Consumers who are not also producers are the industrial drones, but in this discussion they are neglected. Consumers are most successful in consumption when, viewed conversely, they produce most successfully. Whatever stabilizes the productive system supplies the consumer with more goods. Whatever disorganizes production increases costs and diminishes output. Failure to distinguish capital and income creates various kinds of losses which sooner or later are charged to the consuming public. Bankruptcy losses are of this character, as are also the costs of receiverships and reorganizations. When depreciation costs are neglected spendthrift consumption is encouraged, because costs are understated and profits overstated. This is in turn followed by a period of contraction when retrenchments are made to place production back upon its previously efficient basis.

The Investor

Of all parties, the investor is most vitally concerned because he risks a considerable part or perhaps all of his wealth in a single enterprise. As consumer, one is ordinarily interested in a multitude of enterprises, but the possibility of substitution or of retrenchment along various lines of consumption tends to ameliorate the effect of unfortunate ventures. This is far less true of investors. The possibility of substituting one investment for another is often more apparent than real because of the loss necessarily incurred when the investor attempts to dispose of his depreciated securities. Dividends are sometimes paid out of capital. The investor considers it as income and in spending it is not aware that he thus diminishes his wealth. Nothing will do more to make people careful investors than to teach them the distinction between capital and profit; also that in determining profits an allowance must be made for the depreciation of most capital assets.

The Business Man

The business man is actively engaged in the management of industry. He meets continuously problems of principle and detail which he must solve. Frequently the details of routine consume energy that he would prefer to use in the consideration of more fundamental questions of general policy. He cannot neglect those costs of production which occur in the form of depreciation without incurring damaging results. They are intimately connected with the policy of making repairs and replacements, of making betterments and extensions, and less directly with that of price-fixing and general financial control. There are powerful influences at work which tend to make the business manager a disciple of the theory that depreciation is wholly a question of policy and that consequently its nominal amount is strictly subservient to the good appearance of the income statement. No one appreciative of the influences that shape business policies can disregard this attitude toward the question. It can only be remedied by spreading among bankers and investors a better comprehension of the real significance of the nature of depreciation, namely, that it is a cost of production as truly as are fuel and labor. Income tax legislation has done more than all else toward bringing to bear a more enlightened attitude regarding this phase of the matter.

The State

The State demands from industry in the form of taxes an amount of money which in recent years has been enormously increased by the necessities of great military undertakings. The chief source of our government's revenues is now the income tax, and since depreciation is always a proper deduction in the determination of net income, the imposition of relatively high rates of taxation makes the proper allowance for depreciation a matter of vital importance. Standardization of depreciation rates is something which must be attempted with caution; nevertheless, with proper allowance for climatic influences and other variable factors, the central authority of the government can do much toward standardizing depreciation rates and spreading helpful information among interested parties.

An illustration of this is the issuance recently, by the Treasury Department, of a pamphlet entitled *Manual for the Oil and Gas Industry,*[1] which gives information derived from sufficiently abundant sources to be of much assistance to taxpayers in determining fair allowances for depreciation and depletion. Other government authorities, particularly the Federal Trade Commission, are strategically placed and adequately equipped to render service of a similar character.

The State is directly interested in certain lines of endeavor for reasons other than the derivation of a revenue. Ordinarily competition furnishes the regulating and invigorating forces of industry, so that it has become customary to say that "competition is the life of trade." But under certain conditions this theory breaks down. The class of enterprises which we designate as "public utilities" are monopolistic and it is either impossible or undesirable to permit that degree of duplication of these facilities necessary to secure competition. As a consequence there has arisen a policy of government regulation and control which has been made effective through the action of commissions and the decisions of the courts. Two theories have arisen as a result of this development, the agency theory and the competitive theory.

According to the agency theory of government regulation, the status of a public utility corporation in relation to the State is that of an agent in relation to his principal, so that the law of agency in general applies. The advocates of the competitive theory assert that the purpose of commission control is to "perpetuate the conditions of competition."[2] The discussion of these theories in detail must be deferred to later chapters; their mention here will serve to indicate the intimate relationship existing between public utilities and the State, for whether the State acts as principal to agent or as a power that seeks to reproduce the conditions of competition where competition is nonexistent, it becomes necessary for it to enter intimately into the consideration of rate-making and the preservation of invested capital.

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[1] Issued under the Revenue Act of 1918. (See also Appendix A.)

[2] See *American Economic Association Quarterly,* Apr., 1910, p. 191.

A Problem in Cost Accounting

Quite aside from the question of the preservation of invested capital is that of the distribution of depreciation to the cost of output of a certain commodity or service. This means taking the total depreciation for the month and, so far as may be proper, distributing it over the commodities manufactured or the services rendered with a view to burdening each unit of output with its due amount of depreciation cost. Depreciation is cost as much as are labor, fuel, and raw materials. This is a fact still far from universal acceptance. If a full discussion of this aspect of depreciation will serve to show that it is wrong to attempt to set aside a part of net profits to cover depreciation sustained, it will have served a useful purpose. Just as accurate and rapid accounting procedure is facilitated by the keeping of perpetual inventories of raw materials, so the application of the same principles to a plant ledger will serve to bring the more fixed parts of an industrial plant into their proper relationship to the financial and manufacturing processes of each current fiscal period.

CHAPTER II

GENERAL THEORY OF DEPRECIATION

Scope of Term

"Depreciation" is used in this chapter in its most comprehensive sense as including all forms of deterioration of wealth. Such a broadly interpreted term is necessarily indefinite because of its wide scope. As we proceed it will be necessary to place such special limitations on its use as circumstances require.

Causes of Depreciation

It is impossible to enumerate all the specific causes of depreciation. Generally they are classified under the three heads: wear and tear, obsolescence, and inadequacy; but this is merely a generalized statement, and, in reality, the specific causes of depreciation are numerous.

The paving of streets over mains has been in one instance cited as a cause of depreciation of the mains [1] and in another of their appreciation. Loss resulting from casualties is properly considered as depreciation, although of an extraordinary character.[2] Quality of construction, adequacy to meet future demands, manner of operation, and thoroughness of minor repairs and renewals, are factors which affect depreciation—the last being in accordance with the principle that "a stitch in time saves nine." Excessive heat and humidity, and extreme cold tend to affect the life of certain types of property.[3] Whether or not depreciation is affected by appreciation and by adaptation and solidification is a disputed question.

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[1] See Whitten, R. H., *Valuation of Public Service Corporations,* I, pp. 154-55.

[2] *I. C. C. Uniform System of Accounts for Telephone Companies,* p. 68; also *Journal of Accountancy,* Feb., 1919, p. 92.

[3] Erickson, H., *Depreciation,* p. 12.

The depreciation of intangible property may be related in one way or another to that of tangible property, or it may be quite independent of it. Patents, copyrights, and leaseholds depreciate independently of any physical deterioration, and the same is sometimes true of goodwill. On the other hand, intangible assets which depreciate with the depreciation of tangible property are usually directly dependent upon it. Certain engineering and developmental costs are of this nature.[4] It appears that in case of such intangibles as patents, copyrights, and leaseholds the progress of depreciation is in direct proportion to expired life. This suggests a discussion of depreciation between dates.[5]

Depreciation of property may result from tax capitalization,[6] because taxation is equivalent to ownership by the State of such part of the worth of an enterprise as the capitalization of the tax is equivalent to. Matheson,[7] an English authority, gives the following causes of depreciation:

1. Wear and tear.
2. Tenure of holding.
3. Permanency or steadiness of industry.
4. Exhaustion of raw materials.
5. Obsolescence due to new inventions, new product, or better ways to make the same product.
6. Vicissitudes and catastrophes not insurable.
7. Fluctuations in trade.
8. Inadequacy.

Depreciation Defined

Any tabulation of the causes of depreciation is necessarily incomplete and is suggestive rather than definitive. No general definition of depreciation can be given which will be universally applicable and at the same time be of much value in any specific application. The term is usually employed in a limited sense. Sometimes it is given decidedly conflicting interpretations without the difference in use of the term being indicated except by inference from the accompanying text. Therefore the best procedure is to follow the most generally accepted interpretations of the word and of its derivatives, making reference when necessary to unusual and peculiar variations from them. Thus "depreciation" is sometimes employed to include losses made good through repairs; sometimes, on the other hand, repairs are specifically excluded. When, as in this instance, there appears to be no very accurately defined procedure, it is best to make a statement to the effect that depreciation does or does not include repairs. Ordinarily we proceed from general terms to limited terms and special interpretations.

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[4] See Floy, H., *Valuation of Public Utilities,* p. 215.

[5] See p. 36.

[6] *American Economic Association Quarterly,* Apr., 1910, pp. 193-94.

[7] *Depreciation of Factories,* pp. 36-41.

INTERPRETATION BY AUTHORITIES.—The interpretations placed upon the word by some of those who have given thought to the subject will help one to arrive at a better conception of depreciation. One writer expresses it as "loss in value which has occurred arising from the period during which the property of the undertaking has been in service," [8] and adds that "depreciation is, properly speaking, an operating expense and should be charged or treated as other operating expenses." [9]

Depreciation is in the nature of a fixed charge rather than one varying with service.[10] The Interstate Commerce Commission has defined depreciation as "exhaustion of capacity for service," as "lessening in cost value," as "lessening in worth of physical property." [11] The Federal Trade Commission says that depreciation is the most important overhead expense.[12] An English authority employs the term "expired capital outlay" as synonymous with depreciation.[13] The Supreme Court of Missouri calls it "invisible rot." [14]

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[8] Hayes, H. V., *Public Utilities: Their Cost New and Depreciation*, p. 7.

[9] *Ibid.*, p. 136.

[10] *American Economic Review*, I, p. 476. The opposite view is that depreciation should be considered as a capacity cost varying with output. Various considerations render this theoretically untenable, although it is recognized by many authorities as a practical method.

[11] *I. C. C. Valuation Docket No. 2*, pp. 48, 125, 183.

[12] *Fundamentals of a Cost System for Manufacturers*, July 1, 1916, p. 12.

None of these definitions lays stress on the depreciation occurring between dates, and we naturally infer that we are to consider it as a cost to be evenly distributed over the useful life of the asset in question. We infer this from the statement that depreciation is in the nature of a fixed charge rather than one varying with service. Note, however, the following in this connection:

> Expressed in mathematical terms, it is now a more or less accepted axiom of business management that the losses from depreciation from any given piece of property, or of the water supply system as a whole, through a number of years constitute a geometrical series of which the loss of each year is a small percentage greater than for the preceding year, while the aggregate loss at the expiration of the life of such piece of property, or system, is equal to its initial cost, less its scrap value at the end of such useful life.[15]

This means that depreciation cost is progressive, growing greater from year to year in the case of a water supply system or other given property and that depreciation during successive equal periods is not uniform but progressively increasing. The question of depreciation between dates is one of much complexity, however, and its detailed consideration is found elsewhere.[16]

The whole body of theory and fact that has grown up around the depreciation question remains indistinct unless we distinguish the question of ordinary accounting procedure necessary to make replacements, from the question of valuations. Undoubtedly there is much in common between the two problems; nevertheless there has grown up a body of principles and rules governing valuations which are only in part derived from information of an accounting character and which are to a large extent dependent for their adequate functioning upon a wide range of financial and economic facts and circumstances. We are at this point strictly concerned only with the accounting phase of the depreciation question, yet it is necessary to emphasize the two aspects of the question in order to secure an adequate conception of the problem.

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[13] Leake, P. D., *Depreciation and Wasting Assets* (1917), p. 202.

[14] *Home Telephone Co. v. City of Carthage*, 235 Mo. 644.

[15] *Uniform Accounts for Systems of Water Supply*, p. 27. Adopted in 1911 at a conference representing the United States Census Bureau, American Waterworks Association, New England Waterworks Association, American Association of Public Accountants, Ohio Bureau of Uniform Public Accounting, and others.

[16] See pp. 36, 37.

The monthly or annual depreciation allowance is a return of a part of the investment and should be included as part of the charge made to the consumer.[17] This conforms with the assertion of the Interstate Commerce Commission that depreciation is the "lessening in cost value due to the smaller number of service units in the property as found, than in the same property new."

Depreciation Classified

Depreciation, in its broadest sense,[18] comprehends all losses arising from physical or functional deterioration, and may or may not cover the cost of current maintenance. It may be thought of as affecting the various units composing plant, or as affecting the whole plant. Depreciation is therefore either unit or composite depreciation accordingly as we refer to a unit of plant or to the plant as a whole. Composite depreciation equals the sum of the depreciation of the units.

This difference exists between the two: Unit depreciation progresses until it causes displacement of the unit, while composite depreciation rarely does more than reduce the whole plant or system to a status of normal depreciation, beyond which further depreciation is prevented by replacements.

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[17] *Report of the Special Committee to Formulate Principles and Methods for the Valuation of Railroad Property and Other Public Utilities,* American Society of Civil Engineers, Dec. 1, 1913, p. 32.

[18] Its significance is limited in later chapters.

UNIT DEPRECIATION.—Machines and other units of considerable importance must be replaced from time to time. They become worthless except for scrap or salvage. Machines embody in themselves utility created by their manufacturers. By use this is exhausted and becomes an element of cost of the commodities it produces. Thus, in the words of Leake, the capital outlay on the machine expires, and to avoid a continuous expiration of capital outlay on the entire plant, the machines, rolling stock, power producing and distributing systems, etc., which compose plant, must be replaced when they become ineffective. When a machine which has been transferring its utility into commodities for twenty years collapses, it should not be replaced from current revenue, unless replacements of such a kind are scattered evenly enough over monthly intervals not to make such replacements an undue burden upon the current month.

COMPOSITE DEPRECIATION.—Even with current maintenance properly met, depreciation of the whole plant continues, due to the fact that all units of which it is composed are approaching the end of their useful life. Adequate maintenance may make the useful life somewhat longer than poor upkeep would do, but its effect is in any case limited and in many instances quite negative because of the influence of obsolescence or inadequacy. After perhaps twenty-five years many parts, if not already replaced, have exhausted much of their useful life. All parts cannot be kept new. Possibly during the early years of the plant's existence no extensive renewals, but only light repairs, are required; nevertheless the useful life of each unit of which the plant is composed is growing shorter. When more extensive renewals and repairs become necessary they do not bring the plant back to its condition of original newness but serve merely to check even greater depreciation, because the renewed parts have useful lives to supplant the exhausted ones of the displaced units.

On first thought it may appear that depreciation of plant will continue until it is 50 per cent exhausted, because the average length of the remaining lives of all units will tend to become one-half the average of their full duration. But a large part of the investment in plant may not depreciate at all so that normal depreciation may not constitute more than 20 or 30 per cent of cost.

COMPOSITE DEPRECIATION AND CAPITALIZATION.—If the amount of outstanding stock is not diminished composite depreciation results in overcapitalization, since a part of the investment has disappeared. Such overcapitalization may be prevented either by reducing total capital through retirement of stock in an amount equivalent to the composite depreciation, charging the cost of retirement to revenue, or by creating a replacement reserve sufficient to offset the depreciation, retaining capital at the original figure.

This reserve may be used to make extensions where not required for replacements; the effect is to make it equivalent to a replacement. Consequently all parts of the plant bought, up to the limit of the reserve, compose two classes: (1) actual replacements, and (2) new units which replace losses resulting from partial depreciation of units still operating.

As it is customary in making an actual replacement to charge the depreciation reserve with the cost of the item replaced (see Chapter IV), a slight complication arises here, because no specific replacement is made, and it would therefore be impossible to charge the reserve with the cost of any particular unit of plant. The reserve therefore remains credited with the full amount, and is charged only when a unit is discarded and without regard to the time when the new assets are installed.

If assets exceeding in cost the total depreciation accrued are purchased, they are, to the extent of the excess, extensions, because total investment is increased. When due allowance is made for depreciation accrued the distinction between replacements and betterments works out automatically in the balance sheet. Thus, if the following balance sheet represents the true status of Company A:

Balance Sheet of Company A, as at......

Plant	$100,000		Capital Stock Outstanding	$110,000
Less: Res. for Depr.	20,000	$ 80,000		
Cash		30,000		
		$110,000		$110,000

then the following balance sheet shows the situation after an extension equivalent to a replacement is made:

Balance Sheet of Company A, as at......

Plant	$100,000		Capital Stock Outstanding	$110,000
Less: Res. for Depr.	20,000	$ 80,000		
New Building .		20,000		
Cash		10,000		
		$110,000		$110,000

The $20,000 paid for the new building is the amount which was charged to gross revenue as depreciation expense when the depreciation reserve was credited. It represents a return of the investment to the company because that much of the investment has gone out in services or output. Had it been employed to amortize capital the balance sheet would appear thus:

Balance Sheet of Company A, as at......

Plant	$100,000		Capital Stock Outstanding	$ 90,000
Less: Res. for Depr.	20,000	$ 80,000		
Cash		10,000		
		$ 90,000		$ 90,000

Had the new building cost $30,000, it would be partly equivalent to a replacement ($20,000), and partly a betterment ($10,000), because $10,000 of the $30,000 cash on hand represents original investment, not revenue withheld to compensate depreciation. The balance sheet would then appear as follows, although the amounts of the replacement and of the extension might not be always separately shown:

Balance Sheet of Company A, as at......

Plant	$100,000		Capital Stock Outstanding	$110,000
Less: Res. for Depr.	20,000	$ 80,000		
New Building:				
Replacement	$ 20,000			
Betterment..	10,000	30,000		
		$110,000		$110,000

The above discussion is theoretical and neglects certain practical considerations. It might not be always advisable or desirable to use the reserve for securing additional plant or equipment, and if it were, it might not be advisable to use all that has been reserved for depreciation for that purpose. It might be better to issue new stock, or float a loan, to get the necessary money, using only part, or even none of the amount so reserved. Other practical considerations arise, such as the amount of cash necessary to be kept on hand, the money market, and the numerous factors that influence business practices and policies.

If formed by equal annual charges, the depreciation reserve accumulates rapidly while the plant is young and renewals are few, and should be sufficient to allow a part of capital to be amortized, as suggested, or to secure the replacement of investment losses resulting from composite depreciation by installing needed improvements. If capital is amortized the charge necessary to afford a fair income is lessened. In either case the plant's efficiency should increase, since efficiency may remain at 100 per cent even where there is normal depreciation, while depreciation makes it possible to extend the plant to a certain extent without increasing the investment.

Functional Depreciation.—Viewed from the standpoint of cause rather than of effect on plant units and composite plant, depreciation is either functional or physical.

Functional depreciation results from the obsolescence or inadequacy of a plant unit, a combination of plant units, or an entire plant.

The extent to which service could be cheapened, in case of obsolescence, or bettered, in case of inadequacy, by displacing old units with new, determines the amount of functional depreciation of the old units. When the written-down value of the old unit can be added to the cost of a new one and still permit production to be carried on at a lower capital cost, the old unit is wholly obsolete or wholly inadequate. One well-known authority writes:[19]

> If the units in the plant as a whole should be replaced with exactly the same kind of units as are discarded, which is the case in replacing the parts of the unit itself, it would seem that the plant as a whole would become obsolete or inadequate, and would have an end to its life just as the units

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[19] Allison, J. E., *Re Theoretical Depreciation*, p. 29.

> have ends to their lives in actual practice through obsolescence and inadequacy. But, in replacing the units of a plant, we are not compelled, as we are by the rigidity of the machine in replacing its separate parts, to put back the identical article which is worn out. Replacement should be understood as replacement of capital and not as replacement in kind. In replacing the units of a plant as a whole, obsolescence and inadequacy are counteracted by changing the type or capacity of the unit. In consequence of this flexibility in replacement, the plant as a whole does not come to an end, and all the forces working for the destruction of the usefulness of the plant are thus counteracted, and its value wholly preserved, so far as physical equipment is concerned.
>
> It should therefore be seen that while functional depreciation may be reasoned into a piece of machinery which will ultimately disappear, it cannot properly be applied to the plant as a whole. Functional depreciation even as a theory, rests upon an assumed definite end to the life of the thing depreciated. It cannot be applied to a utility which has no definite or foreseeable end.

This statement contains an element of truth, but for accounting purposes it is inapplicable, while for purposes of valuation it is misleading and incomplete. It is conceivable that a valuation will show that present value of plant is as much as or greater than cost. This is not because depreciation does not exist, however, but because appreciation in some parts has occurred or because a going-concern value has been established. It is absurd to suppose that depreciation cannot take place where maintenance is adequate, for the simple reason that the expired outlay or partial depreciation of units of plant cannot be compensated by current maintenance. Moreover there are instances where whole plants do become obsolete or inadequate.

INADEQUACY.—Inadequacy in a progressive industrial world is an extensive cause of depreciation. It results from the changes in financial policy, engineering progress, and unexpected developments.[20] Recently the numerous consolidations have resulted in the abandonment of much physical property not adequate to meet the requirements of more extensive service. To construct plant of sufficient size and capacity to meet remote future demands, even though there is good reason to believe that such extensions will be needed, may be more costly than to build for present and near future requirements, thus leaving the needs of the distant future to be taken care of through reconstruction on a more extensive scale. The element of chance militates against an attempt to build now for such demands as may arise in the distant future.

Inadequacy cannot be prevented by repairs and consequently should be provided for by a reserve for contingencies whenever that is possible.[21] In some instances in the recent past depreciation from inadequacy has been very great, while there is not the same likelihood of inadequacy in the future because the developmental stage of the industry has been passed. Steel railroad bridges are cited in illustration.[22]

Repairs may serve to extend the life of freight cars until they are scrapped because of inadequacy.[23]

There always comes a time when retention of a given implement is economically undesirable. At that time inadequacy is effective. The margin of effectiveness has been more or less gradually diminished by invention or by increasing demand preceding such time. Inadequacy arises from changing demand which determines the rapidity with which it occurs. Demand for a greater amount of service may be a gradual growth, so that the old unit may be profitably continued in service for a time or else salvaged and given another cycle of usefulness where requirements are lighter, as when light steel rails are removed from the main tracks to side tracks to make way for heavier rails. It may be nearly proportionate to time expired when it approaches gradually because of increasing demand for service.

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[20] Hayes, H. V., *Public Utilities*, I, p. 172.

[21] Whitten, R. H., *Valuation of Public Service Corporations*, I, p. 349.

[22] *I. C. C. Valuation Docket No. 2*, p. 128.

[23] *Ibid.*, p. 129.

Depreciation due to inadequacy may be found by the same method as that used to find depreciation due to obsolescence,[24] or on the basis of the capitalized cost of production of a unit of output. The latter is the better method if more than one old unit of plant is required to perform the same work that one new unit will do. Thus, if the total cost of producing a unit of output with an old machine is $20, and with the new machine $18, the saving per unit is $2. If the number of units of output produced with the old machine is 100, the total saving is $200. $200 ÷ .05 = $4,000, which sum represents functional depreciation of the old plant and the amount over and above the depreciated value of the old plant which the company can afford to pay for a new machine, providing the old one can be disposed of at its depreciated value. Since the amount that old property usually brings upon sale is but a small percentage of cost, it may be that it will be more economical to retain it for some time after more efficient types of machinery have been placed on the market. A machine should not be replaced until it is really obsolete; it is not obsolete until its written-down value can be added to the cost of a new machine and yet enable production to be carried on at a lower capital cost than with the old machine in operation. Naturally, the question of salvage or of another cycle of usefulness where the demand on service is not so heavy is of great importance in solving the problem of inadequacy in any given case.

Obsolescence.—Obsolescence and inadequacy are similar in one respect, namely, the difficulty of making an accurate forecast of their probable occurrence; but of the two, inadequacy is easier to forecast than is obsolescence. Inadequacy results from causes which are largely or wholly external, such as increase of demand. A 40 horse-power engine is replaced by a 60 horse-power engine of the same type because the 40 horse-power engine is inadequate to the demands made on it. A 40 horse-power engine may, however, be replaced by a 40 horse-power engine of an improved type, not because it is incapable of doing the work but because it is not economical, i.e., it is obsolete.[25] In a general sense, inadequacy is a question of size and power while obsolescence is one of type and quality. Frequently obsolescence is caused by laws and ordinances, as, for example, when a process or a machine is condemned. A good illustration of obsolescence is the substitution of electric transmission for older forms of power conveyance.

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[24] See p. 28.

Obsolescence was recognized as a proper deduction by the English income tax law in 1897.[26]

Depreciation from obsolescence and inadequacy may be actual, probable, possible, or improbable. Sometimes the possibility of its occurrence is sufficiently remote to be negligible.

Depreciation from obsolescence and inadequacy may be considered from the point of view of accounting and from that of valuation. In *National Telephone Co., Ltd. v. His Majesty's Postmaster-General,*[27] which involved the determination of the value of the property of the National Telephone Company, of England, upon its transfer to the government, no deduction was made for probable future obsolescence and inadequacy, but due allowance was made for all functional depreciation actually existing. In *Gately & Hurley v. Delaware & Atlantic Telephone and Telegraph Co.,*[28] involving the valuation of a telephone plant for rate purposes, the Board of Public Utility Commissioners of New Jersey determined upon a deduction for depreciation resulting from wear and tear, but made no deduction for depreciation based on obsolescence and inadequacy, although its existence was recognized. The Commission followed a similar course in *Re Rates of the Public Service Gas Co.,*[29] but its decision seems to have been influenced by the fact that the company in charging off depreciation had not included "theoretical depreciation," which term appears to be employed synonymously with "functional depreciation." The Commission said:

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[25] H. V. Hayes says there are two conditions involved in obsolescence—improved character of service and increased efficiency. (*Public Utilities*, I, p. 170.)

[26] Matheson, E., *Depreciation of Factories*, p. 29.

[27] Quoted in Whitten, R. H., II, pp. 1150-52. Decided Jan. 13, 1913.

[28] N. J. B. P. U. C. 519; 14 A. T. & T. Co. Com. L. 39 (Jan. 7, 1913). Quoted in Whitten, R. H., II, p. 1154 *et seq.*

> We believe that from this time forth allowance for depreciation should be made where possible, on the theoretical basis, but where depreciation has been charged off, the amount charged off appears to have been not theoretical depreciation, but merely amounts which would measure depreciation ascertained by inspection. We therefore conclude that we are on certain ground when the allowance for depreciation which is deducted from the cost to reproduce the property new is the amount representing the wear and tear and aging, and when we do not attempt to estimate the greater amount which would allow for obsolescence and inadequacy.

The Wisconsin Railroad Commission in *City of Milwaukee v. The Milwaukee Electric Railway & Light Co.,*[30] a case involving valuation of a street railway for rate purposes, based an adequate depreciation allowance upon functional as well as physical depreciation. Naturally the problem in a valuation for public purchase differs from that in a valuation for rates, since in the former the problem consists in determining a fair purchase price from a consideration of past policy and history, while in a rate valuation the problem consists in paying to a company enough to protect legitimate investment. If in the past a company has charged to depreciation only enough to cover wear and tear, while in reality depreciation from obsolescence and inadequacy has accumulated, then to deduct this latter in a valuation for purchase would be taking something for which no payment has been made. Such losses should of course be returned sooner or later through rates, but if they are not and if a deduction is made for them in determining the purchase price then the company stands to lose the amount of the functional depreciation. On the other hand, in fixing a valuation for rates and prescribing a return thereon adequate to cover obsolescence and inadequacy a commission projects a future policy which enables the company to make charge for depreciation sufficient to cover obsolescence and inadequacy.[31] Thus it appears that there is a very direct relationship between accounting practice and the question of valuation.

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[29] N. J. B. P. U. C. 433; 15 A. T. & T. Co. Com. L. 354 (Dec. 26, 1912).

[30] 11 W. R. C. R. 1; 14 A. T. & T. Co. Com. L. 197 (Aug. 23, 1912). (Whitten, R. H., II, p. 1203.)

That property abandoned because of obsolescence or inadequacy is a charge to current operation when no reserves have been raised to cover it, is held in the report of the special master in *South & North Alabama R. R. Co. v. R. R. Commission of Alabama.*[32] He says, in opposing the contention of the defendant, that abandonment due to obsolescence and inadequacy is not depreciation:

> It makes no difference whether the old garment or structure has become too small for the boy or inadequate for the railroad; in either case its worth is only the scrap value and in either case the necessity is the same to renew as it would be if the last day of actual life had expired. The loss must fall somewhere, and naturally it comes out of the expenses of the year. . . . There is no doubt, however, that the whole charge, if it could be foreseen as one obliged to come within a given time, might, with propriety and justice have been anticipated by a special reserve fund raised against the years between the periods of preparation for abandonment and actual abandonment—but that would spread the charge over

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[31] But see pp. 26-34.

[32] Report of William A. Gunter, Special Master in Chancery, 1911. See Whitten, R. H., II, p. 1204.

> several years, I suppose, prior to June 30, 1910, but in no event can it be projected against or into the future.
>
> There is no data by which it can be prorated with past years, and it belongs in the current year in which the loss (the abandonment) occurred.

It will be granted that such extraordinary burdens ought, whenever possible, to be distributed over a period of years; but this period of years ought ordinarily to follow and not precede the time of abandonment, even though inadequacy and obsolescence are oftentimes ascertainable before abandonment becomes desirable.

Losses from obsolescence and inadequacy are allowed as deductions for income tax purposes by the Bureau of Internal Revenue, but it appears that the regulations, in providing that,[33] when "through some change in business conditions, the usefulness in the business of some or all of the capital assets is suddenly terminated, so that the taxpayer discontinues the business or discards such assets permanently from use in the business, he may claim as a loss for the year in which he takes such action the difference between the cost, or, if acquired prior to March 1, 1913, fair market price or value as of that date of any assets so discarded (less any depreciation sustained and allowable as a deduction in computing net income) and its salvage value remaining," allow for losses of the nature of obsolescence and inadequacy only when actually realized. Proof must also be given of some unforeseen cause by reason of which the property must be prematurely discarded, as:

1. Replacement by new invention; or
2. Abandonment of manufacture of a product because of increase in cost or other change, and to which special machinery is exclusively devoted; or
3. New legislation rendering profitable use of property impossible.

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[33] *Reg.* 62, Art. 143.

The method pursued by the Bureau is decidedly objectionable for the reason that in going concerns obsolescence and inadequacy are not costs of production but costs of replacement which should be added to the cost of the asset which replaces the obsolete or inadequate one abandoned. Only ordinary wear and tear should be made a deduction, except in cases where the entire enterprise is abandoned. If desirable to forestall obsolescence and inadequacy, a reserve for future contingencies may be set up, but this should be regarded strictly as a reserve of surplus.[34]

Let us assume the case of a machine which costs $10,000, has an estimated natural physical life of ten years, and an estimated scrap value of $1,000. If the machine lives out its natural physical life, i.e., if neither obsolescence nor inadequacy causes it to be abandoned before it is worn out, it will be cared for by the usual method of setting up a depreciation reserve against which its cost less salvage is charged when abandoned. But there are two possible alternatives: First, the machine may, before the expiration of the tenth year, become incapable of performing the amount of work demanded of it because of an increase in that amount. Secondly, it may become unprofitable to continue using the machine because another could be purchased which would do the work equally well at a smaller cost per unit of output. Under the first assumption the machine is inadequate; under the second assumption it is obsolete. It is easy to see that the factors or influences which give rise to the one are not the ones that give rise to the other. This difference should be borne in mind.

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[34] H. B. Fernald says: "The most important difference between what is admitted under the income tax and what is good business and accounting procedure is that from a business standpoint it is often desirable to create reserves sufficient to meet any probable future contingencies, whereas the income tax regulations do not admit of such charges except when and as such contingencies actually occur." (*Journal of Accountancy*, XXV, pp. 245-256.) A valuable and suggestive article which the student will do well to review. It is the present author's belief, however, that such deductions should never be made except as charged off over the life of the new asset installed to replace the old one, the cost of which is composed in part of the obsolescence which made the abandonment of the old one necessary.

Nature of Obsolescence.—It is the writer's belief that the failure to do more than merely generalize on this subject has led to the scrapping of a great amount of equipment which was neither inadequate nor obsolete when scrapped. This has happened because accountants and managers fail to realize that in a going concern there can be no such thing as a capital loss, that every expense of production must be charged to cost of production, and that therefore the entire cost of wasting assets must be included in the *cost* of production, whether or not all plant units live out their natural physical life. This truth is given effect by establishing depreciation reserves which are intended to return the cost of wasting assets out of revenue during their natural physical lives. Sometimes an attempt is also made to forestall obsolescence and inadequacy, either by setting up excessive depreciation reserves or by setting up special reserves which are of the nature of reserves for contingencies. No fault can be found with reserves for contingencies if they are thoroughly understood and if they are regarded as true surplus and not as valuation reserves. But the writer believes that no reserves of any kind are necessary or desirable for the proper handling of obsolescence and inadequacy, because the cost of a unit of plant should be written off by means of a charge to depreciation based on the natural physical life of such unit; and where such rate does not cover cost due to the shortening of useful life from obsolescence or inadequacy the uncovered cost or cost not returned through such normal depreciation rate should be added to the cost of replacement and written off over the natural physical life of the new unit.

There are several reasons why this ought to be the procedure. In the first place it is impossible to make adequate provision in advance for either inadequacy or obsolescence because the time of occurrence of either cannot be forecast. This is true in particular of obsolescence, and it is true in only a less degree of inadequacy. We rightly regard wear and tear as an accruing expense in which the element of time is a determining factor; but we wrongfully assume that time has any relation to obsolescence and inadequacy. Obsolescence and inadequacy do not accrue in the sense that interest and wages and depreciation from wear and tear do. On the other hand they are similar to losses from fire or storm or to the cost of tearing down a structure, which cost is added to the cost of the structure which replaces it. Obsolescence should not result in the partial writing down of the unit under consideration; on the contrary it either causes the given unit to become immediately or entirely worthless or it has no financial effect whatever. It is illogical to speak of a unit of plant as being partially obsolete. As long as it is profitable to continue an existing unit in operation it is not obsolescent in any effective sense because obsolescence is purely a matter of relative costs of production, not of physical condition. Obsolescence becomes effective only when production can be carried on more cheaply by replacing a given unit, *the undepreciated or unrecovered cost of which unit is considered as a part of the cost of replacement.* Obsolescence, therefore, when effective, is measured by the amount by which cost less salvage exceeds the amount of the depreciation already written off at any given time.

How Obsolescence Is Determined.—Returning to our assumed illustration of the machine which cost $10,000 and possesses an estimated life of ten years and a residual or scrap value of $1,000, let us further assume that five years of useful life have expired and that at the close of each year a depreciation reserve has been credited with one-tenth of $10,000—$1,000, or $900, so that now there exists a reserve of $4,500. There is, of course, an additional $4,500 to be accounted for, either in the form of future charges to depreciation or as obsolescence or inadequacy. Now suppose that at the end of the fifth year a new machine which costs $8,000 comes on the market and will perform equivalent service at a smaller total cost per unit of output. The problem is to determine whether or not the old machine is obsolete. The two elements which enter into cost of production are: (1) the unrecovered investment in the machine, and (2) necessary current expenses, such as labor and power. We may assume that an investigation shows these items for the old and new machines, respectively:

Old Machine		New Machine	
Unrecovered cost, i.e., cost less depreciation earned...	$5,500	Unrecovered cost, i.e., cost less depreciation earned...	$8,000
Current operating expense..	600	Current operating expense..	400

If money is worth 6 per cent, the capitalized cost of operating the old machine is $600 ÷ .06, or $10,000; that is, it is equivalent to a capital investment of $10,000, whereas the capitalized cost of operating the new machine is $400 ÷ .06, or $6,666.67. Adding these to the original costs of the respective machines we have for the old machine:

Original cost less earned depreciation............	$ 5,500.00
Capitalized operating cost........................	10,000.00
Total capitalized cost............................	$15,500.00

and for the new machine:

Original cost....................................	$ 8,000.00
Capitalized operating cost........................	6,666.67
Total capitalized cost............................	$14,666.67

Therefore, as compared with a new machine of equal capacity, the old machine is worth $4,666.67, which is obtained by deducting the excess in total capitalized cost of the old machine over that of the new machine ($833.33) from the unrecovered investment in the old machine ($5,500). But since its salvage value is only $1,000, to scrap it would mean a loss of $4,666.67 — $1,000, or $3,666.67, and no saving in total capitalized cost of production, because when the old machine is valued at $4,666.67 it produces as cheaply as does the new machine. The true total capitalized cost of production if the old machine were scrapped would be:

Original cost of new machine	$ 8,000.00
Unrecovered cost of old machine (less salvage)	4,500.00
Capitalized operating cost	6,666.67
	$19,166.67

whereas the capitalized cost of operating the old machine is only $15,000. If, however, the new machine could be bought for $8,000—$4,166.67, or $3,833.34, then the new and old machines would be on a par and it would be immaterial whether the replacement were made or not. The same would be true if the capitalized operating cost of operating the new machine could be reduced to $6,666.67—$4,166.67, or $2,500 (which is an operating expense of $150 capitalized at 6 per cent), for then we should have:

Original cost of new machine	$ 8,000.00
Unrecovered cost of old machine (less salvage)	4,500.00
Capitalized operating cost	2,500.00
	$15,000.00

These calculations show that before a machine can be said to be obsolete it must be shown that production can be carried on more cheaply with a new machine to whose cost has been added the unrecovered cost (less salvage) of the old one. They also show that unless a machine is made entirely obsolete by a new invention it is not affected in any way whatever because it continues to be cheaper to operate the old machine than to scrap it and buy the new one.

TREATMENT IN ACCOUNTS.—The fact that the unrecovered cost (less salvage) of the old machine must be added to the cost of a new machine in order to determine whether the old machine is obsolete does not of itself make it compulsory that the unrecovered cost (less salvage), which is the measure of effective obsolescence, be capitalized in determining cost of replacement. We must therefore inquire further into what disposition ought to be made of this cost of obsolescence. The following methods of procedure are open to consideration:

1. Charge it to current operations.
2. Charge it to surplus.
3. Capitalize it and then recover it through depreciation charges based upon the expected natural physical life of the unit which replaces the one which has become obsolete.

TREASURY RULINGS.—There is good reason why obsolescence ought not to be charged to current operations except under unusual circumstances, although it is, perhaps, the plan now most frequently pursued. Until the passage of the revenue law of 1918 no deduction was allowable for obsolescence until the obsolete property was sold or otherwise actually disposed of. Section 214 (a-8) of the 1921 law provides that in computing net income there should be permitted as a deduction:

> A reasonable allowance for exhaustion, wear and tear of property used in the trade or business, including a reasonable allowance for obsolescence.

Article 161 of *Regulations* 62 provides, furthermore, that:

> . . . For convenience such an allowance will usually be referred to as depreciation, excluding from the term any idea of a mere reduction in market value not resulting from exhaustion, wear and tear, or obsolescence. The proper allowance for such depreciation of any property used in the trade or business is that amount which should be set aside

> for the taxable year in accordance with a consistent plan (not necessarily at a uniform rate) by which the aggregate of such amounts for the useful life of the property in the business will suffice, with the salvage value, and having due regard for expenditures made for current upkeep, at the end of such useful life to provide in place of the property its original cost (not replacement cost) or its value as of March 1, 1913, if acquired by the taxpayer before that date.

Article 166 furthermore provides that:

> . . . Inasmuch as under the provisions of the income tax acts in effect prior to Revenue Act of 1918 deductions for obsolescence of property were not allowed except as a loss for the year in which the property was sold or permanently abandoned, a taxpayer may for 1918 and subsequent years revise the estimate of the useful life of any property so as to allow for such future obsolescence as may be expected from experience to result from the normal progress of the act.

Various rulings and decisions have been handed down by the Bureau of Internal Revenue but none of them draws a clear line of distinction between depreciation from wear and tear and obsolescence, while some of them use the words "depreciation" and "obsolescence" as if they were synonymous.

It may be inferred, therefore, that the Treasury regards obsolescence as a proper charge to current operations; but this stand is made upon the assumption that obsolescence is an accruing expense in the same sense as is physical wear and tear. We have endeavored to show that this is not true; that, on the contrary, from the nature of the case, obsolescence cannot accrue before it actually occurs any more than a loss due to a fire can accrue before the fire occurs. Moreover, to charge obsolescence to the period preceding the time when the property actually becomes obsolete is in effect to say that since a new invention made in the future will greatly cheapen production we shall burden the present period not only with its due proportion of accruing expenses but we shall also add to such expenses the cost of scrapping good machinery in order to make way for machinery which will give still cheaper costs in the future.

Which Period Should Bear the Burden?—In reality obsolescence cannot usually be foreseen for any considerable period of time because of the fortuitous character of the events which cause it, and it is about as logical to attempt to accrue future fire losses as to attempt to accrue future obsolescence costs. But there is this difference between a fire loss and an obsolete asset. The thing destroyed by fire is entirely destroyed and possesses no further producing capacity, whereas the obsolete asset invariably possesses additional producing capacity which is not utilized because it is not profitable to do so. The reason it is unprofitable to utilize the asset is because the cost of the old machine not yet recovered through depreciation charges to operations can be added to the cost of a more up-to-date machine and still enable production to be carried on at a smaller total cost than if the old machine were continued in use. Since every dollar of investment should be charged against output, it is reasonable that the cost of scrapping machinery not yet worn out be charged against the output of the period which gets the benefit of the more economical machinery.

Another way of putting the matter is to say that all costs of wasting assets must be recovered through depreciation rates based upon the natural physical life of such assets; and that whenever the cost of any asset is not so returned during the period of its usefulness because of the shortening of life from obsolescence then such unrecovered cost should be recovered during the natural physical life of the asset which replaces it. Depreciation rates are presumably based on scientific estimates of the life of the asset in question, and it is possible, where a great amount of data regarding longevity of physical assets has been collected, to determine the normal expected life with great accuracy so long as no attempt is made to allow for factors which none can foresee with any degree of certainty, such, for instance, as accidents, obsolescence, and other contingencies. Much has already been done in the way of establishing mortality tables for important classes of assets based upon extensive data derived from experience. Rates based upon such tables will be meaningless if we are arbitrarily to increase them to meet contingencies which by nature are uncertain and may, indeed, never occur. We have shown, moreover, that the cost of obsolescence is not one which accrues from the time an asset is installed until it becomes obsolete. It is rather in the nature of a deferred charge to be distributed over the period which follows its occurrence, or, in exceptional instances, to be charged directly to surplus.

Attitude of Interstate Commerce Commission

The Interstate Commerce Commission in its instructions to engineers engaged in the valuation of railroads, under the act of Congress passed in 1913, has issued the following instructions on functional depreciation:[35]

> As to the present, the engineers are instructed to consider functional depreciation which has already accrued. If the bridge is too light for the equipment being used and should be removed as soon as possible, that fact must be taken into account. If the station is too small to accommodate the traffic now flowing through it, that must be a controlling item in its depreciation. So of all other pieces of property. The depreciation has already taken place; the thing is no longer fit for its use and must be discarded. This being so it makes no difference whether the cause be physical or functional.
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> As to the near future, the instruction is that functional depreciation shall only be considered when it is imminent. This word admits of no exact definition. *If in the near*

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[35] *I. C. C. Valuation Docket No. 2,* p. 127.

> *future such depreciation is certain to occur, or reasonably certain to occur, it must be considered by the engineer.* If, for example, the railroad has already begun to remove bridges of a similar type because they are too light, this fact must be considered. If, while the station may do for a few years to come, plans are already being considered for its replacement, the architect must not close his eyes to this circumstance and look only to the physical condition of the property. *Generally speaking, in so far as functional depreciation can be accurately forecast, it must be considered, but speculation must not be resorted to.*[36]

This may be the correct procedure in a valuation, but it does not indicate what is the correct accounting procedure. No greater source of waste exists today than in the scrapping of plant not yet wholly obsolete. This waste will not be scientifically prevented until the cost of scrapped plant not covered by depreciation reserves based on physical life is regarded as a cost of replacement.

Physical Depreciation

Physical depreciation results from wear and tear and such other forms of deterioration as are the natural result of increasing age. Ordinarily it excludes the cost of current repairs [37] and will be so understood unless otherwise stated. Experience will ordinarily enable those familiar with the nature and use of physical property to forecast its natural life with a reasonable degree of certainty.

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[36] Italics are author's.

[37] See *I. C. C. Uniform System of Accounts for Telephone Companies* (1913), p. 67.

CHAPTER III

GENERAL THEORY OF DEPRECIATION
(CONTINUED)

Depreciation Between Dates

The time which expires between the day of installation and the day of abandonment of an asset is its lifetime or period of usefulness. If it costs, say, $100 and is salvaged for $10, then $90, in terms of cost, represents total depreciation, ordinary maintenance not being included in depreciation. If the life of the asset is nine years, then, on an average, there occurs an annual depreciation of $10 per annum. Is such an average distribution correct, or does there in reality accrue a greater or less amount during either the earlier or later years of its period of usefulness? Considerable significance attaches to this question.

The Interstate Commerce Commission in its valuation report on the Texas Midland Railroad says:[1]

> It is assumed that the loss of these units of service is evenly distributed throughout the entire life of the article. In point of fact this is not exactly true. Some articles may depreciate more rapidly in the early years of service and others in the last years, but the practical way is to assume that the loss is uniform, and it is believed that this as applied generally will produce a fair result.

The regulations of the Bureau of Internal Revenue, for purposes of the income tax, assume equal amounts of depreciation in equal periods of time. This means that expired time is the basis upon which depreciation is computed. The Bureau will permit the use of other bases, however, such as gross earnings, or output.[2] If gross earnings is the basis then depreciation is made a function of income. If output is the basis then depreciation is a function of production. However, for income tax purposes the government does not recognize periods of less than one year.[3] The English Ministry of Munitions recognizes equal day-to-day depreciation.[4]

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[1] *I. C. C. Valuation Docket No. 2* (July 31, 1918), p. 125.

Depreciation Is Financial in Character

The word "depreciation" refers to the financial effects produced by deterioration, wear and tear, obsolescence, and inadequacy. If depreciation be thought of as covering financial loss due to exhaustion of mines then depletion expresses the physical fact. This does not correspond to usage, however. The word "depreciation" does not express the nature of the loss. This is done by employing descriptive words which indicate either physical processes of deterioration or those which are functional.

Viewed from the financial side, capital invested in plant has two aspects, namely, cost and value. Accounting deals with cost rather than value, and replacement allowances are made on the basis of the cost of the unit to be replaced, not on the basis of its exchange value or on the cost of replacement.

DEPRECIATION CAPITALIZED.—When returns have been insufficient to permit proper reserves to be established, depreciation resulting from wear and tear may be considered a development cost and capitalized.[5] Ordinarily, however, the capitalization of depreciation arising from wear and tear is erroneous, for this results in meeting its cost through the issuance of new securities, a mistake not infrequently made.[6] Depreciation occurring during the construction period is properly capitalized.[7]

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[2] *Reg.* 62, Art. 165.

[3] Montgomery, R. H., *Income Tax Procedure*, 1919, p. 701.

[4] Leake, P. D., *Depreciation and Wasting Assets* (1917), pp. 202, 207.

[5] *In re Sale of Berlin Electric Light Co.*, 3 N. H. P. S. C. R. 174 (Aug. 30, 1913).

DEPRECIATION AS EXPENSE.—The New York Public Service Commission, First District, says:[8]

> In determining operating expenses year by year, an allowance to meet such depreciation was included as a charge against income, for rates should be such that the consumption of capital may be offset by deductions from income.

Depreciation was held to be an expense by the Supreme Court of Iowa in 1902,[9] but this position was reversed in 1909.[10] The United States Supreme Court disallowed depreciation in 1903[11] but reversed its decision in 1909.[12] In the report of the master in *Spring Valley Water Co. v. City & County of San Francisco et al*, the fully accrued depreciation was allowed in operating expenses each year and in addition considerable renewals on the ground that a sufficient fund had not been accumulated to cover these renewals.[13]

If depreciation is an expense it is also a cost of production and this raises the question of its proper distribution to consumers—a question in cost accounting discussed elsewhere.[14] Depreciation is one of several fixed charges, taxes, interest, and so on. Whether costs of individual units of output, or merely collective costs, are required, will affect the problem. It is probably impracticable to find the cost of individual rates in distributive and transportation industries, but practicable to find individual costs in manufacture.

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[6] Erickson, Halford, *Depreciation*, pp. 10-11.

[7] *Journal of Accountancy*, XXV, p. 243.

[8] *Mayhew v. Kings County Lighting Co.*, 2 P. S. C. 1st D., N. Y. (Oct. 20, 1911).

[9] *Cedar Rapids Water Co. v. City of Cedar Rapids*, 118 Iowa 234 (Oct. 27, 1902).

[10] *Cedar Rapids Gas Light Co. v. Cedar Rapids*, 144 Iowa 426 (May 4, 1909).

[11] *San Diego Land & Town Co. v. Jasper*, 189 U. S. 439 (Apr. 6, 1903).

[12] *Knoxville v. Knoxville Water Co.*, 212 U. S. 1 (Jan. 4, 1909).

[13] *American Economic Review*, VIII, p. 181.

[14] See p. 109. In distributive industries, such as gas and electric companies, the basis of consumption at the "peak" is not feasible, says J. M. Clark. He thinks that the capacity of individual fixtures, and actual maximum demand, would be practical bases. (*American Economic Review*, I, p. 477.)

Depreciation as an element in cost of service was definitely upheld by the United States Supreme Court in the leading case of *Smyth v. Ames,*[15] and has been followed in most later cases. The adoption of value of service, rather than cost, as a basis for rates does not alter the general truth that depreciation is an element of cost of service.[16]

Depreciation versus Repairs

Ordinarily, depreciation and repairs should be treated as separate problems.[17] If the depreciation reserve is credited with an amount sufficient only to provide for the original cost of the asset in question, then all other costs than the original cost—repairs, renewals of parts, etc.—should be charged to income and not to the depreciation reserve. The proper function of the depreciation reserve is to provide for replacement of original cost; consequently repairs and replacements of minor parts should be charged to income. Of course if the amount reserved for amortization of original cost is too large the taxpayer cannot expect to receive full allowance for this amount and at the same time charge repairs and incidental replacements to expense.

A nice problem is to determine where the line should be drawn between repairs and minor replacements chargeable to income and replacements chargeable to the depreciation reserve. Where a detailed plant ledger is kept this problem, to a great extent, solves itself; but otherwise there is likely to be some difficulty in handling each case satisfactorily. Moreover the rate of depreciation is to some extent dependent upon the policy pursued in making repairs.

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[15] 169 U. S. 466 (Mar. 7, 1898).

[16] In the general railroad law of 1850 the New York legislature recognized depreciation as expense and included four depreciation accounts in maintenance expenses.

[17] See Appendix D.

If the plant is varied and extensive and has settled down to a normal condition the cost not only of repairs but also of extensive renewals for any given fiscal period is about the same as for another and there may be no objection to charging these renewals direct to income. This plan is impracticable when renewals are of such a character that one period is burdened too much and another too little because of lack of uniformity in the distribution of renewal costs.

The depreciation reserve performs an important function by equalizing the burden of cost of renewing those parts which are so extensive that to charge their cost direct to income would result in excessive deductions from revenue in a particular period. Therefore depreciation allowances should be large enough to cover this kind of renewals and in addition to cover the depreciation which accrues while a plant is passing from its condition new to its condition of normal depreciation; because normal depreciation cannot be made good by repairs or renewals except in the infrequent event that the plant can be renewed in its entirety.

In case of telephone companies the Interstate Commerce Commission permits "extraordinary repairs" to be charged to depreciation reserve each month by a correcting entry crediting Repairs. As the charges to this account are many, the amount reserved for depreciation must be correspondingly large.[18]

The distinction between repairs and depreciation has been drawn in numerous instances. In *re Queens Borough Gas & Electric Co.*,[19] Commissioner Maltbie explained the difficulty in ascertaining the amount of depreciation made good by maintenance. No definite rule can be formulated and the situation varies with the nature of the undertaking and the policy pursued. In New York, First District, the system of accounts distinctly provides that renewals of line—poles, fixtures, cables, and wires of the transmission and distribution systems—be covered in maintenance because of the difficulty of keeping detailed records of such equipment. If depreciation is figured by the straight-line method the inclusion of renewals and replacements in repairs chargeable direct to profit and loss will tend to make the depreciation reserve excessive, unless care is exercised to keep the cost of all items whose renewal is charged to current operations out of the amount on which the reserve is reckoned. To accomplish this some kind of plant ledger should be kept for all items chargeable to the reserve at the time of replacement.

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[18] Kurtz, W., "Depreciation in Telephone Utilities," *Journal of Accountancy*, XXVII, pp. 85, 86, 89.

[19] 2 P. S. C. 1st D. N. Y. 544 (June 23, 1911).

The Appellate Division of the New York Supreme Court emphasized the necessity of depreciation reserves in addition to ordinary maintenance, as follows:[20]

> Perhaps the evidence would justify the conclusion that the amount allowed for maintenance is sufficient to replace from time to time, as may be necessary, the mains, hydrants and some of the other tangible property of the company. But it must have expensive pumps and machinery and other property which is liable to serious depreciation by use, and in time to actual destruction, so that prudence would require that each year a certain reasonable sum be laid aside as a replacement or up-keep fund for such contingencies as are not covered by the ordinary maintenance charges.

This wording is unfortunate in that it suggests that a "sum be laid aside," thus seeming to imply that it must be kept out of the business in the form of an investment—a meaning which was probably not intended; yet even if so meant it is in no way subversive of the principle at issue.

The distinction between depreciation and maintenance should be drawn still more emphatically. Maintenance secures daily efficiency but does not in any scientific manner prevent the impairment of total investment. This is the function of depreciation allowances, which must be based upon a comprehensive plan. Maintenance is necessarily haphazard in so far as continuity is concerned; moreover its cost is not uniform and ordinarily increases with advancing age of the asset.[21] At best maintenance does not prevent the existence of a condition of normal deterioration nor does it make any provision for the resulting financial effect on invested capital. In *San Joaquin & Kings County Canal v. Stanislaus County*[22] the court separated current repairs from depreciation and required a separate provision for the latter.

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[20] *People ex rel. Jamaica Water Supply Co. v. Tax Commissioners,* 128 App. Div. (N. Y.) 13 (Sept. 17, 1908).

The report to the Massachusetts Highway Commission on the appraisal of the New England Telephone and Telegraph Company,[23] maintained that total cost of reconstruction can be met adequately only by averaging costs from year to year, since current repairs are inadequate to offset loss resulting from wear and tear, obsolescence, legal regulations, and casualties. Taking into consideration "first cost, rate of depreciation, probable effects of rate of changes in the art and the acts of municipal bodies, special misfortunes caused by the elements," and also considering any salvage that might result, the appraisers concluded that 7.3 per cent of the value of the property exclusive of land, general supplies, and working capital should be charged yearly against income. In *Pioneer Telegraph Co. v. Westenhaver,*[24] the Supreme Court of Oklahoma, stating that current maintenance "represents only the cost of those units that had become so badly depreciated that they had to be replaced during that year," found that 7 per cent of "reproductive value" of physical property would be a proper annual depreciation allowance.

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[21] Hayes, H. V., *Public Utility,* I, p. 163.

[22] 191 Fed. 875 (Sept. 18, 1911).

[23] Mar. 27, 1909. In *17th Annual Report Massachusetts Highway Commission* (1909), pp. 211, 215.

[24] 118 Pac. 354 (Jan. 10, 1911).

The purpose of the depreciation allowance is not only to preserve investment intact but also to prevent "abnormal drains upon the treasury." [25]

However, there is some opposition to the treatment of depreciation as if it were anything more than repairs. In their protest against the methods pursued by the Interstate Commerce Commission's Valuation Committee the railroads insist that maintenance and depreciation are indistinguishable, or rather identical. Certain kinds of property may be continued almost indefinitely through repairs, in which case ultimate abandonment may result rather from functional than physical depreciation.[26] Sometimes, too, repairs may result in what are in reality betterments, as when embankments widen and settle through additions of material chargeable to maintenance.[27] It may be admitted that railroad companies have some reason for this assertion and that such a policy does not necessarily indicate lack of conservative procedure. Nevertheless there is almost unanimity of opinion among accountants that depreciation reserves perform a function quite distinct from that of current maintenance and we assume that they are a recognized feature of good practice.

The system of accounts prescribed for public utilities by the New York Public Service Commission requires that depreciation be estimated in gross, that is, covering repairs as well as more extensive replacements, and against this estimate actual repairs are charged as made from month to month. Thus if, on a predetermined basis, the gross depreciation for a given month is fixed at $20,000 and during that month $11,000 is expended for repairs, then $9,000 will be credited to the depreciation reserve for that month.[28] This is booked as follows:

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[25] Hayes, H. V., *Public Utilities,* I, p. 138.

[26] *I. C. C. Valuation Docket No. 2,* p. 129.

[27] *Ibid.,* p. 132.

[28] Seidman, F. E., *Journal of Accountancy,* XXIV, p. 356.

Repairs	$11,000	
To Cash		$11,000
For repairs made during month.		
Depreciation	9,000	
To Reserve for Depreciation		9,000

This plan possesses the advantage of providing an equal charge from month to month, but it makes the amount reserved for depreciation dependent upon the amount expended currently for repairs, which is not a logical procedure. The chief objection to this procedure, from an accounting point of view, is that there is no assurance that cost will be amortized during the lifetime of a given unit, because the amount reserved for depreciation is a variable dependent on repairs.

If any additional reason is required to substantiate the usefulness of the depreciation reserve it is found in the income tax as now administered. Under the federal income tax law of 1921 the depreciation allowable is prorated over the life of the asset and in order that he may secure proper credits for expired capital outlay the business man should set up depreciation reserves adequate to cover such costs.[29]

For a long discussion attempting to show that maintenance is equivalent to depreciation the reader is referred to J. E. Allison's paper entitled *"Re Theoretical Depreciation,"* which is a criticism of a report made by Dr. Weber, statistician of the New York Public Service Commission, First District, entitled, *"Accounting for Depreciation."* The gist of Mr. Allison's contention is that when we speak of keeping unimpaired the "value of the property invested" we mean not money value but service value, which latter term means "continued ability to give service of the original efficiency."[30] As explained elsewhere in this volume,[31] efficiency bears no direct relation to depreciation, and retention of efficiency has no certain relation to value in any sense.[32]

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[29] Under earlier regulations, after any given time only that part not expired was returnable, whether or not a deduction had been made previously for depreciation. It is now provided that "adjustments in respect of depreciation or depletion in prior years will be made or permitted only upon the basis of affirmative evidence that as at the beginning of the taxable year the amount of depreciation or depletion written off in prior years was insufficient or excessive, as the case may be." (*Reg.* 45, Art. 839, also Art. 161.) See article by H. B. Fernald, *Journal of Accountancy*, XXV, p. 243.

There are too many instances of bankruptcy and overcapitalization[33] resulting from failure to reserve sufficient income to cover depreciation to make it possible to adopt the policy of haphazard replacement in preference to one based on sound principles of accounting. It is quite true that too great an allowance is objectionable and that in some instances it is not so essential that depreciation be distinguished from repairs as in others; yet this does not invalidate the general applicability of the principle that depreciation must be so handled that the cost of an asset is returned through income during its period of usefulness and that its cost is properly spread as a cost of production or service over its lifetime. This is what is meant in the following statement of the United States Supreme Court:[34]

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[30] Allison, J. E., *Re Theoretical Depreciation*, p. 79.

[31] See p. 61.

[32] The reader may compare with Mr. Allison's interpretation the following authoritative statements:

Mr. L. R. Nash says: "It is the custom of many companies to retain not less than 10 per cent of their gross earnings before dividends are declared, or to retain from 20 per cent to 25 per cent for depreciation and maintenance together, recognizing the intimate connection between the two, and that the latter may necessarily be variable from year to year." (*Valuation of Public Service Properties*, p. 15. Reprinted from *Stone and Webster Public Service Journal*, Oct., 1912.)

Mr. Halford Erickson says: "Wear and tear, or minor renewals are ordinarily made up of repairing and replacing minor equipment as well as the smaller parts of the larger units of the equipment as these wear out, break, or in some way are lost. . . . While expenses of this kind are in the nature of depreciation, they are, as a rule, not included in depreciation allowances but charged separately into the operating expenses. . . . General decay is that part of wear and tear, which is due to age and which cannot be made good through such ordinary repairs." (*Depreciation*, p. 7.) See pp. 16-19 of this pamphlet for Wisconsin practice.

[33] For example, the case of the Chicago and Alton may be taken. It paid unearned dividends in 1907 by "skinning" the property through inadequate maintenance which proper reservations for depreciation would have avoided. (See Ripley, W. Z., *Railroads*, II, p. 77.) The difficulty of comparing so-called net earnings of corporations is complicated by the failure to adopt a uniform depreciation policy. Charging replacement to capital instead of expense resulted in trouble for the Rock Island and the Boston and Maine. The management of the Rock Island maintained that a liberal upkeep policy was in force in 1913. Investigation showed that one-half the company's freight cars were worn out in connection with other "deferred maintenance," a reported surplus of $13,600,000 was eradicated, and a deficit of $10,291,000 shown. This deficit was capitalized by assessment on security holders. Would not this property have benefited by a more conservative depreciation policy?

[34] *Knoxville v. Knoxville Water Co.*, 212 U. S. 1 (Jan. 4, 1909).

> It [the company] is entitled to see that from earnings the value of the property invested is kept unimpaired, so that at the end of any given term of years the original investment remains as it was at the beginning.

Employment of the term "cost" and exclusion of the term "value" where cost is specifically intended, will simplify matters considerably. Practically all accounting for wealth invested in fixed assets is on a cost basis, and bears no relation to present exchange value or to replacement cost. Moreover, the cost of production represented by what P. D. Leake terms "expired capital outlay" is such part of the cost of the fixed assets used for production purposes as is exhausted in the production of any given commodity or service. It is entirely proper that this exhaustion of plant should be charged against the consumer and thus be returned to the enterprise through its revenues. When so returned it is also proper that it be reserved for the purpose of making replacements of abandoned property. By no other method can the expiration of plant value be charged against those who benefit therefrom, namely, the present consumers.

Following are extracts from the income tax regulations of the Bureau of Internal Revenue:

> The cost of incidental repairs which neither materially add to the value of the property nor appreciably prolong its life, but keep it in an ordinarily efficient operating condition, may be deducted as expense, provided the plant or property account is not increased by the amount of such expenditures. Repairs in the nature of replacements, to the extent that they arrest deterioration and appreciably prolong the life of the property should be charged against the depreciation reserve.[35]

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[35] *Reg.* 45, Art. 103. Commenting upon the Bureau's attitude, H. B. Fernald says: "This seems substantially the same distinction which we, as accountants, have been in the habit of making, viz., that there should be charged to expenses the ordinary current expenditures for repairs and minor replacements, including replacements of any parts of machines which are continually wearing out and must frequently be replaced. Depreciation is intended to spread, equitably over the life of the equipment, its original cost, and also the cost of such renewals and replacements as are only required at extended intervals, which, if charged direct into expenses when made, would result in one period bearing more and another period bearing less than its fair share of the cost." (*Journal of Accountancy*, XXV, p. 242.)

> The proper allowance for such depreciation of any property used in the trade or business is that amount which should be set aside for the taxable year in accordance with a consistent plan by which the aggregate of such amounts *for the useful life of the property*[36] in the business will suffice, with the salvage value, *at the end of such useful life to provide in place of the property its cost. . . .*[37]
>
> The capital sum to be replaced by depreciation allowances is the *cost* of the property in respect of which the allowance is made. . . .[38]

In this connection we should remember that repairs bear no direct relation to such cost of property and in no way return it.

A Question of Cost or of Value

We have already found that depreciation presents two problems, one strictly an accounting problem, the other a problem of valuation. That these problems are not merely two aspects of the same thing a little consideration will show. Depreciation, from the accounting point of view, deals strictly with the question of the replacement of wasting assets at cost. It is not concerned with changing market values or with the various more or less permanent fluctuations resulting from the unearned increment in property. As the question of depreciation in valuations stands at present we cannot, unfortunately, reduce it to such a simple basis. If valuations were made on a strictly cost basis then it might be possible to reduce the two questions to one common ground. As a matter of common knowledge, the valuations placed upon various classes of property for various purposes are not, in most instances, based on cost, but are influenced by other factors, such as present market value, appreciation and the unearned increment, reproduction cost, and so on.

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[36] Italics are author's. It is the author's belief, however, that the phrase "natural life" should be substituted for "useful life."

[37] *Reg.* 45, Art. 161.

[38] *Reg.* 45, Art. 164. The extracts given in the text have not been materially changed in *Regulations 62.*

No little confusion has resulted from the indiscriminate use and misuse of the word "value" and its derivatives, "market value," "exchange value," "service value," "wearing value," "fair value," "physical value," and similar expressions. Much of our accounting and economic literature has been vitiated by the misuse of this word.[39] It is sometimes used synonymously with cost or invested capital, sometimes in the sense of market or exchange price, a figure which ordinarily fluctuates from week to week.

Value is most frequently employed in the sense of value in exchange. Therefore if value in exchange is to be taken as the basis of valuations for the purpose of taxation, rate-making, and capitalization, for which procedure there is good authority,[40] the reconciliation of cost or investment with value is usually impossible. However, in the case here cited one commissioner dissented, saying that for capitalization the "money which has been skillfully and economically invested in the property" is the basis of value. In a later case, Chairman Stevens states that value in exchange is not a proper basis in a rate case, since the rate determines value in exchange.[41]

"Fair value" is the phrase most frequently employed by courts and commissions to express what they consider the sum upon which a fair return may be earned. In *Smyth v. Ames* [42] the United States Supreme Court stated that the elements to be considered in determination of fair value are:

1. Original cost of construction.
2. Amount expended in permanent improvements.

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[39] "Value," says W. S. Jevons, the celebrated English economist, "is the most invisible and impalpable of ghosts, and comes and goes unthought of while the visible and dense matter remains as it was." (*Investigations in Currency and Finance*, p. 80.)

[40] Statement of Chairman Stevens, in *Matter of the Application of the Westchester Street Railway Co.*, 3 P. S. C. 2nd D. N. Y. 286 (Apr. 24, 1912).

[41] "To base the rate upon the exchange value would be generally merely to continue the rate, and it would absolutely continue it so far as the value is dependent upon the rate. If the change in rate affects the net income, it changes the exchange value; and if there be no change in exchange value there can be no change in rate." (*Fuhrmann v. Cataract Power & Conduit Co.*, 3 P. S. C. 2nd D. N. Y. 656.)

[42] 169 U. S. 466 (Mar. 7, 1898).

3. Amount and market value of bonds and stocks.
4. Present as compared with original cost of construction.
5. Probable earning capacity of the property under particular rates prescribed by statute.
6. Sum required to meet operating expenses.

Other citations might be given to show that value in the sense of fair value is not necessarily synonymous with "cost," even when cost is legitimately incurred. This means that various changes not necessarily reflected in correct accounting practice may so affect the property in which an investment is made that when the balance sheet shows a net investment of a given amount the fair value may be and, indeed, is likely to be a larger or smaller amount. Having stated the problem of cost versus value here, we leave its further consideration to subsequent chapters.

Normal Depreciation

We have already found that current repairs and maintenance serve to keep a plant in efficient operating condition but do not serve to prevent entirely depreciation, owing to the fact that most of the units are in a partly depreciated condition, that this partial depreciation is a normal thing, and that after a plant reaches an age when the further progress of depreciation is arrested by renewals and replacements it may be said to have arrived at a condition of normal depreciation. The truth has been well expressed by one authority in the statement that "there will be an appreciable period of time between actual wear and the removal of its effect from the system." [43]

If the depreciation reserves are properly set up they express approximately the amount of normal depreciation existing at a given time. The question of whether or not a deduction for depreciation should be made in determining fair value for rates is one of the utmost importance. This question is considered in detail elsewhere. It may be said, in general, that a deduction should not be made for normal depreciation unless it has been earned or unless unearned depreciation has been capitalized as a development cost.[44]

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[43] B. J. Arnold quoted in Whitten, R. H., *Valuation of Public Service Corporations*, I, p. 350. Arnold gives the following rule for determining normal wear: "For all parts which have been in use long enough to have passed through an entire cycle or period of complete repair—determine the entire cost of one complete maintenance, i.e., the cost of a complete renewal of those parts subject to wear. The amount to be deducted for normal wear is 50% of this total maintenance cost, as the average condition of all the parts is midway between the point of complete repair and of normal disrepairs."

Salvage and Scrap

Salvage is the value an article possesses for some use other than that to which it has been devoted. When it can be so used it is said to possess another cycle of life.[45] Junk or scrap value is that which an article is worth if broken up.[46] In making allowance for depreciation the basis to be used is cost less whatever it is estimated that the salvage or scrap will amount to.[47]

Physical property depreciates until it reaches its salvage or scrap value, as the case may be. Beyond this point there is no further depreciation because it either enters a second cycle of life or is broken up and employed elsewhere.

Supersession

When structures are no longer suitable for their intended work they are superseded by those better adapted to perform the work. Supersession occurs before the asset is worn out and may be the result either of obsolescence or inadequacy. Cost of superseded property should ordinarily be capitalized as a replacement cost in case of either public utilities or manufacturers.

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[44] Nash, L. R., *Valuation of Public Service Properties*, p. 17.

[45] See p. 52.

[46] Net scrap value is its fair market price less the cost of turning it over to the dealer.

[47] See Whitten, R. H., I, p. 349; also *I. C. C. Valuation Docket No. 2*, p. 126. H. V. Hayes uses the term "salvage" in a somewhat different sense. He says: "The difference between the scrap value of the unit and its cost of removal is the salvage value of the unit. Salvage may be positive or negative depending upon whether the scrap value exceeds the cost of removal or not." (*Public Utilities*, I, p. 139.) The author prefers the usage adopted in the text because salvage and scrap are distinct but useful interpretations.

Earned Depreciation

Earned depreciation is depreciation for which compensation has been received through revenue. It may be retained as a fund or otherwise employed. When, in case of utilities, rates have been sufficient to pay a fair return on investment and also compensate for costs resulting from depreciation it is said that depreciation has been earned. It is earned even though it is used to pay higher dividends than are justified. In such a case capital is impaired if the enterprise is a private one. If a public utility, the result will depend upon the interpretation given by the commission or court.[48]

Amortization

The word "amortization" is employed in several senses. It is frequently used to refer to the liquidation of a debt, especially through the establishment of a sinking fund. Sometimes it refers to the amount chargeable to expense due to the expiration of leaseholds, the amount so chargeable being proportionate to life expired during a given period.[49] It sometimes refers to the writing down of book figures in order to make them reflect actual conditions. Sometimes it is used synonymously with depreciation; sometimes with reference to loss in value of intangibles, as patents and franchises.

The term is employed by the Bureau of Internal Revenue in connection with war plant and equipment to refer to the special loss resulting therein due to transfer to a peace basis. Article 186, *Regulations* 62, says: "Claims for amortization must be unmistakably differentiated in the return from all other claims for wear, tear, obsolescence and loss." Article 182 says: "The allowance for amortization shall be inclusive of all depreciation during the amortization period on property subject to amortization." Article 183 explains that the amount of the amortization allowance is the difference between the original cost of the property, less amounts deducted for depreciation prior to January 1, 1918, and (1) its selling price if discarded before March 3, 1924, plus a reasonable allowance for depreciation if used after the close of the amortization period, or, (2) if not included in (1), its estimated value in use.

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[48] See Chapter XVII.

[49] As prescribed in *Uniform System of Accounts for Télephone Companies*, prescribed by the Interstate Commerce Commission, Jan. 1, 1913, p. 53.

Casualties

Casualties are industrial accidents, the time of occurrence and their cost being uncertain. They result from floods, storms, explosions, and other fortuitous events. Much of their cost may be covered by insurance. Minor casualties are often charged to maintenance.[50] In the opinion of the Wisconsin Railroad Commission such losses are too problematic in character to be dealt with through the depreciation fund alone.[51]

The Bureau of Internal Revenue includes casualties among its deductions allowable under the law for "losses sustained during the taxable year and not compensated by insurance or otherwise, if incurred in trade or business." Among such are those "arising from fires, storms, shipwreck or other casualty, or from theft. Furthermore the loss should be reduced by the amount of any insurance or other compensation received." [52] These allowances are exclusive of those made for depreciation.

Cycles of Life

A cycle of life is comprehended in the whole period of usefulness of an article in a given position. When an article has a second cycle of life it is second hand, and so on. Ordinarily usefulness ends with the second cycle of life and frequently with the first. Second cycle of life determines salvage value at the end of the first cycle. Thus steel rails are usually subject to relay and the cost of relay rails determines salvage at the end of the first cycle.[53] Second-hand material sometimes is a considerable part of construction and gives rise to certain special considerations in valuations.[54]

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[50] For example, as prescribed by the New York Public Service Commission, First District.

[51] *State Journal Printing Co. v. Madison Gas & Electric Co.*, 4 W. R. C. R. 501.

[52] *Reg.* 45, Art. 141. See also Arts. 49, 50.

Deferred Maintenance

Deferred maintenance is the measure of the neglect to make all ordinary repairs such as are necessary to keep a plant in good running condition. Henry Floy says that it "always reflects to the discredit of the management or the financial ability of a corporation." [55] Ordinarily deferred maintenance is not reflected in the accounts, but it should be accounted for in the same way as other expenses. Such "accrued repairs" may be given proper consideration by charging current maintenance and crediting a deferred maintenance reserve. When later on the repairs are made they are charged to this reserve.[56] Some authorities identify deferred maintenance with depreciation, asserting that when there is no deferred maintenance no depreciation exists.[57] This interpretation has arisen in connection with the valuation of public utilities for purposes of rate-making. For detailed consideration of it later chapters should be consulted.[58]

Unearned Depreciation

Unearned depreciation is in some respects similar to deferred maintenance. It is that depreciation which has been incurred in giving service and for which no return through revenue has been received. It is of interest chiefly in connection with the question of valuations for rate purposes.

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[53] *I. C. C. Valuation Docket No. 2*, p. 184.

[54] *Ibid.*, pp. 34, 35, 125.

[55] *Valuation of Public Utility Properties*, p. 26.

[56] See *Journal of Accountancy*, XXVII, p. 91.

[57] *I. C. C. Valuation Docket No. 2*, p. 48.

[58] See Chapters XVII-XXII.

From a purely accounting point of view it is equivalent to a deficit, and in case of manufacturing concerns and all others not subject to commission control may be regarded as a loss. It may sometimes be regarded as a development cost and capitalized, and there is a reason why depreciation accruing during the developmental period may be unearned depreciation, viz., insufficiency of revenues. Failure to set up a reserve for depreciation does not constitute unearned depreciation; on the other hand the depreciation may be largely unearned when a reserve is established.

Uncovered Depreciation

Uncovered depreciation is like unearned depreciation in that it is not reimbursed through revenue, but it is unlike it in that it is not entitled to be so reimbursed, since it occurs in property which is not presently useful in serving the public. It is the result of unwarranted investments.[59] It arises only in public utility properties because the interpretation of the courts is to the effect that only property "used and useful" is entitled to earn a return.[60]

Completed and Incompleted Depreciation

Under certain conditions, owing to changed circumstances, or to ordinary wear, it becomes necessary to scrap whole parts of a plant. When such a condition arises, depreciation is said to be complete as applied to such portion of the plant as has become useless. Incomplete depreciation refers to the status of a plant or portion of a plant which is only partially reduced in value. As we have seen, this is the normal status of most enterprises. In *Knoxville Water Co. v. City of Knoxville*, Circuit Judge Clark said:[61]

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[59] Whitten, R. H., *Valuation of Public Service Corporations*, II, p. 1158.

[60] "It is settled that the property investment which is to be taken into consideration as one of the elements in fixing such rates is the property then in use." (U. S. Supreme Court.) See Whitten, R. H., II, pp. 1176-77.

[61] Jan. 24, 1905. See citation in Whitten, R. H., I, p. 374.

> If a particular part of the water plant, as originally constructed, in consequence of the growth of the city, or necessary changes in the operation of the plant, or in consequence of deterioration from natural causes of wear and tear, has become unsuitable and has been taken out and completely abandoned to the category of scrap material, or scrap iron, this is treated as culminated or completed depreciation, and its cost or value as completely gone out of the plant. Non-completed depreciation is where, in consequence of wear and tear from natural causes, parts of the plant are undergoing injury and are on the way to complete destruction, but are still in use.

From a strictly accounting point of view the terms "completed" and "incompleted" depreciation bear no special significance other than that which is contained in other and more frequently used words, such as "normal depreciation," "expired outlay on plant," and so on.

Average Life

It is sometimes desirable to find the composite or average life of a plant. Just what the term "average life" signifies is not always clearly understood, however. The average life is the time in years during which the depreciation of all parts will amount to original cost less salvage value. Assume the hypothetical case of a plant consisting of five units with original cost, estimated lives, and salvage values as follows:

Units	Original Cost	Estimated Life in Years	Salvage Value	Cost less Salvage
Unit 1......	$ 1,000	5	$ 100	$ 900
Unit 2......	5,000	10	1,000	4,000
Unit 3......	20,000	15	2,000	18,000
Unit 4......	30,000	20	5,000	25,000
Unit 5......	50,000	23	4,000	46,000

The cost of depreciation each year for the several units is as follows:

Units	Cost less Salvage		Estimated Life		Cost per Year	
Unit 1.......	$ 900	÷	5 years	=	$ 180	
Unit 2.......	4,000	÷	10 years	=	400	
Unit 3.......	18,000	÷	15 years	=	1,200	
Unit 4.......	25,000	÷	20 years	=	1,250	
Unit 5.......	46,000	÷	23 years	=	2,000	
	$94,900	÷			$5,230	= 18.14 yrs.

That is, during a period of 18.14 years the cost less salvage of the plant expires through depreciation. Hence we say that the plant has an average life of 18.14 years. The average life of the plant should not be confused with an average of the lives of the units of the plant, which is found by totaling the lives of the units and dividing such total by the number of the units. In this instance this is 14.6, a figure possessing no special significance.

The Depreciation Base

By the "depreciation base" is meant the figure or sum upon which the rate of depreciation is figured.[62] The selection of a correct base is a problem of utmost importance, because together with the rate it determines the amount of the periodic charge. One base may be more inclusive than another.

For private industries the base should ordinarily be the cost of the asset in question,[63] because it is desired to secure the return of the investment during the useful life of the asset. There may, of course, be exceptions to this rule; and accountants are by no means agreed that the depreciation rate, in times of rising prices, may not be based on replacement cost instead of original cost. Also in case of discoveries of ore bodies and the like where a fair valuation within thirty days after discovery is an allowable basis under the revenue law, the procedure for purely internal purposes should be made to conform to the procedure for tax payment. The depreciation base in manufacturing industries has a direct bearing upon price-making and competition, so that its selection must be made with a view to the effect which it will have on costs.

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[62] See Appendix D. for policy of Treasury Department.

[63] On May 3, 1918, the Rulings Board of the Finance Department of the Bureau of Aircraft Production, in interpreting the standard cost-plus contract ruled that: "Normal depreciation to be allowed as Actual Cost shall be based on original cost as shown by the books. Where reliable book values are not available, the original cost shall be based on the estimated original cost of the property, without any deduction for accrued depreciation. In no case shall depreciation be based on the cost of reproduction at present prices." (*General Ruling No. 28.*)

In case of publicly regulated industries the situation is somewhat different, and the problem becomes one of securing a base which will be equitable to both investors and the public. Let us note a few cases. In *Columbus Railway & Light Co. v. City of Columbus,*[64] it was said that the depreciation allowance in plants devoted to the furnishing of light and power by electric current throughout the country amounts to "5 per cent. of the total *cost* of the plant including real estate, where the real estate constitutes but a nominal portion of that cost." Likewise, H. V. Hayes [65] says that "reserves for renewals must be figured always upon the actual *original cost* and never upon the replacement cost."

However, cases may be cited in which cost of reproduction is the accepted base. In *San Joaquin & Kings River Canal & Irrigation Co. v. Stanislaus County,*[66] the court, accepting 33 years as the life of the perishable structures in the plant, said that "an annual allowance should be made for such depreciation, and, on the basis that *reproduction* of these structures" would cost $315,515.14, the court permitted an annual allowance of 1/33 that amount, or $9,561.06. In *Pioneer Telephone & Telegraph Co. v. Westenhaver,*[67] the court said that "7 per cent. of the *reproductive value* of the physical property is fair and sufficient to allow for annual depreciation." This base was also used by the Wisconsin Railroad Commission in *Superior Commercial Club v. Superior Water, Light & Power Co.*[68]

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[64] Whitten, R. H., *Valuation of Public Service Corporations,* I, p. 427.

[65] *Public Utilities,* II, pp. 14-15.

[66] 191 Fed. 875 (1911).

[67] 118 Pac. 354 (1911).

Sometimes "depreciable property" is declared to be the base. This is probably, though not necessarily, analogous with cost. An investigator in one case said that "2 per cent. on *depreciable property* is sufficient to cover this requirement." [69] The Canada Board of Railway Commissioners allowed 6.77 per cent on the book value of *depreciable property* in one case.[70] In Arizona 3½ per cent on the *depreciable property* was allowed.[71]

In *Cumberland Telephone & Telegraph Co. v. City of Louisville* [72] an annual allowance of 7 per cent on *depreciated property* was allowed.

The Depreciation Method

Having decided upon the base, it is next necessary to determine the manner in which this shall be amortized or written down. The various formal methods are discussed elsewhere.[73] Sometimes depreciation is made proportional to or at least dependent upon gross earnings. This is sometimes known as the "hit-or-miss" method. L. R. Nash says: [74] "It is the custom of many companies to retain not less than 10 per cent. of their gross earnings before dividends are declared, or to retain from 20 to 25 per cent for depreciation and maintenance together. . . ." Henry Floy says: [75] "It has the advantage of regulating the amount provided for depreciation in accordance with the gross income, but a fund so provided may have no proper relation to the depreciation actually taking place. . . ." The following table taken from Floy[76] shows the policy of several companies:

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[68] Whitten, R. H., *Valuation of Public Service Corporations,* II, p. 1203.

[69] Report of Wm. J. Hagenah to the Chicago Council Committee on Gas, Oil and Electric Light, April 17, 1911, relative to the People's Gas Light and Coke Company.

[70] Whitten, R. H., II, p. 1191-92.

[71] *Ibid.,* II, p. 1189.

[72] 187 Fed. 637, 655 (1911).

[73] See Chapters VII and VIII.

[74] *Valuation of Public Service Properties,* p. 15.

[75] *Valuation of Public Utilities,* p. 199.

Name of Company	Per Cent of Gross Revenue Expended or Appropriated For Maintenance	Depreciation
Milwaukee companies:		
Railway departments	11.30	9.90
Gas, electric light, and steam heat departments	6.15	8.12
United Railways Co. of St. Louis	13.67	10.00
Union Electric Light & Power Co., St. Louis	4.95	16.00
Suburban Electric Light & Power Co.	7.10	10.85
Detroit Edison Co. and subsidiaries	6.45	10.23
Omaha & Council Bluffs Street Railway Co.	7.00	10.00
Chicago Street Railways	6.00	8.00
Philadelphia Rapid Transit Co.	Undivided	15.00

The New York Edison Company bases its depreciation charge on the kilowatt-hours output. Some street car companies charge a certain amount for depreciation for each car-mile run. In Cleveland 5 cents per car-mile has been allowed to cover both maintenance and depreciation. In Brooklyn the subsidiaries of the Brooklyn Rapid Transit system have allowed amounts varying from 2.7 cents to 4.4 cents per car-mile for equipment of surface roads and from 1.4 cents to 2 cents per car-mile for the equipment of elevated or partly elevated railways.[77] In *Cedar Rapids Gas Light Co. v. Cedar Rapids,* one expert suggested 5 cents per 1,000 cubic feet of gas manufactured for depreciation.[78] In *Buffalo Gas Co. v. City of Buffalo,*[79] 5.3 cents was allowed on each 1,000 cubic feet of gas sold, on an assumed sale of 633,000 M. cubic feet. Many gas and electric companies which come under the jurisdiction of the New York Public Service Commissions base their depreciation allowance on their unit of sales, and in this case the allowance is supposed to be enough to cover both depreciation and repairs.[80] The Bureau of Internal Revenue now specifically recognizes this method.[81]

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[76] *Ibid.*

[77] Whitten, R. H., *Valuation of Public Service Corporations,* I, p. 428.

[78] *Ibid.,* II, p. 1198.

[79] 3 P. S. C. 2d D. N. Y. 553.

The "natural life" or the "useful life" may be employed when determining the rate. If the natural life is employed, the depreciation rate covers only ordinary wear and tear and deterioration, whereas if the useful life is employed an attempt is made to cover obsolescence and inadequacy,[82] in case these tend to shorten what would be the useful life were they not present. The Bureau of Internal Revenue specifies the useful life as the term over which to charge off the capital sum.[83] In case of mines the plant and equipment should be written down on the basis of useful life when their natural life is longer than the life of the mine; otherwise their natural lives should determine the rate of depreciation.

The foregoing discussion should serve to emphasize the need of care in determining both the depreciation base or capital sum to be amortized and the proper period over which to perform such amortization, as well as the specific method of accomplishing it.

Relation of Depreciation to Efficiency

Every plant must be maintained at a certain degree of efficiency, to enable it to meet the various demands made upon it for service. In some cases, such as the telephone business, the general efficiency must be kept very high, otherwise dissatisfaction with the service soon appears. While a close connection exists between efficiency and depreciation, a distinction must at the same time be recognized. Of course, a loss of efficiency in a unit of plant must in time inevitably occur as the result of depreciation. But loss of efficiency of the whole plant does not occur in any degree proportionate to loss by depreciation. In fact, composite depreciation of plant may give rise to little or no loss of efficiency.

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[80] Seidman, F. E., "Depreciation Accounting for Public Utility Companies," *Journal of Accountancy*, XXIV, p. 355.

[81] *Reg.* 45, Art. 165. See also Fernald, H. B., "Depreciation and Obsolescence," *Journal of Accountancy*, XXV, p. 245.

[82] For a discussion of obsolescence, see pp. 21-34.

[83] *Reg.* 45, Art. 165.

The failure to distinguish between depreciation and efficiency may account for the failure of many managements to make due allowance for depreciation. Oftentimes it is said that this or that machine is as good as new, after being used, say, ten or fifteen years; and as the time of discard seems indefinite, nothing is written off. It is true that the element of uncertainty is always present even in the most careful attempts to make depreciation allowances. But much of the confusion arises from a failure to recognize the essential difference between loss of efficiency and loss of capital assets through depreciation.

CITY OF BELOIT V. BELOIT WATER, GAS & ELECTRIC CO.—Buildings, machines, tools, etc., remain in unimpaired efficiency for years. But sooner or later they must wear out or become obsolete or inadequate. In this connection the statement of the Wisconsin Railroad Commission in *City of Beloit v. Beloit Water, Gas & Electric Co.*[84] is of interest, being to the effect that erroneous ideas of the value of property that has been in use for some time without requiring extensive repairs, are apt to be formed, but that the time always comes when a casual observation can detect the loss of value.

EFFICIENCY DEFINED.—Depreciation and efficiency must be carefully distinguished, the difficulty being due partly to a confusion or misunderstanding of the terms.

Efficiency is a word of frequent occurrence in modern business parlance. It applies both to labor and to machinery. As to machinery it raises questions of construction, adequacy, suitability, and general usefulness. It is the practical test of present effectiveness, to which most other considerations are subordinate. Beauty of architecture in buildings and gracefulness of construction in machines are desirable, but under competitive conditions such considerations give way to the all-important question of efficiency. Efficiency is prized and sought after; inefficiency is shunned and despised. In men, efficiency consists in highly specialized or broadly developed faculties; in machines, in powerful construction or delicately adapted mechanisms. Its possession is always coveted, and its loss always regretted.

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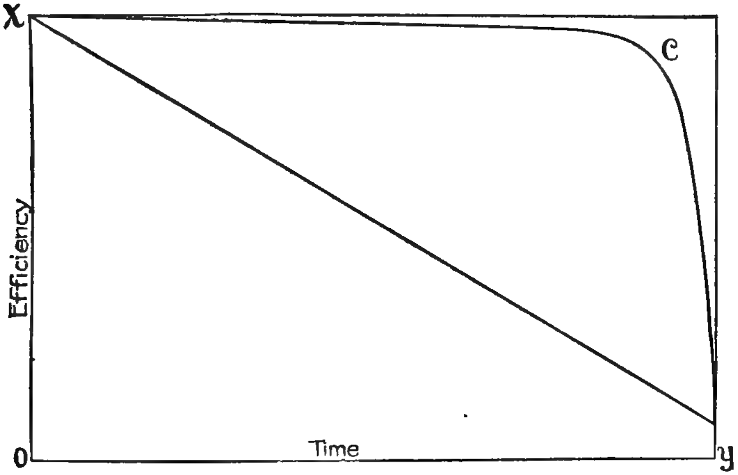
[84] W. R. C. R. 187, 235 (July 19, 1911).

THE FACTORS OF VALUE.—But efficiency, the test of present usefulness, is not the only factor that determines value. Value depends upon present usefulness, it is true, but it also depends upon the length of time over which such usefulness will continue. Two similar machines may be equally efficient today; but one may continue to be useful for two years and the other for four. Can we say that they have equal value? There may be some uncertainty in individual cases; but the uncertainty is limited within certain bounds, and to a great degree vanishes when averages are considered, just as the uncertainties of lifetime vanish when large numbers of lives are considered. The lifetime of a single freight car is very uncertain, but the average lifetime of a thousand cars is ascertainable to the fraction of a year.

COMPARISON OF DEPRECIATION AND EFFICIENCY.—Form 1 represents the character of depreciation figured on a straight-line basis, also of efficiency, both curves applying to the same unit of plant. If the distance from o to x represents the efficiency of a new machine, or 100 per cent, and the distance from o to y represents the lifetime of the same machine, say, ten years, then the straight line xy represents the progress of the theoretical straight-line depreciation, while the curved line xcy indicates the rapidity with which efficiency declines.

From this diagram it will be seen that, whereas the efficiency of the machine continues almost unimpaired until the tenth year, the theoretical straight-line depreciation reduces the value of the machine by an equal amount, nearly 10 per cent, each year. Objection may be made on the ground that this straight line does not represent actual depreciation, and that should a sale occur at the end of the fifth or sixth year the machine would very likely bring considerably more or less than 50 per cent of cost. Although this is true, it should be remembered that depreciation is usually figured with reference to future replacement, not future sale.



Form 1. Curves Showing Progress of Uniform Depreciation and of Diminishing Efficiency

From this standpoint it does not ordinarily matter greatly if theoretical and actual depreciation do differ considerably at times during the life of a unit. Actual depreciation is always somewhat indeterminate, yet it is a consideration of vital importance in valuation work.

In place of the straight line to represent depreciation, one of the more complicated curves may be adopted, but in no case would such a curve correspond even approximately with the line indicating decrease of efficiency. Depreciation is determined, theoretically, by the method of computation adopted; and while it is desirable to have this correspond as nearly as possible to actual depreciation, it is uncertain, except after investigation, which method most closely approximates this result. While it may be desirable to accumulate a reserve whose growth exactly counterbalances the gradually decreasing value of the asset, it is perhaps more important that it shall be sufficient to make the necessary replacements when desired.

INVESTMENT TO BE PRESERVED.—From what has been said it is apparent that while in the long run efficiency is dependent upon the extent to which depreciation has occurred, it may for a long time remain quite independent of accruing depreciation. High present efficiency ought not, therefore, to be used as an excuse for failing to make adequate provision for depreciation. Such a short-sighted policy can only lead to difficulties later on. Not merely efficiency must be retained, but the investment as well, and for the continued prosperity of the concern one is as necessary as the other.

Efficiency is the test of present daily effectiveness. Depreciation is the slow process by which industrial plant, whatever its present effectiveness may be, gradually approaches the time of discard and replacement.

EFFICIENCY NOT TO BE IMPAIRED.—In case of extensive plants, as water works, electric railways, and so on, a composite condition results from the existence of a large number of units of plant of different kinds in various stages of depreciation. Constant repairs and replacements prevent the plant as a whole from dropping in value below a certain percentage of cost new, or cost of reproduction. If we assume that normal depreciated plant value is 80 per cent of reproduction cost, it is evident that the original investment has depreciated 20 per cent in spite of renewals. But efficiency should remain at 100 per cent as long as all necessary repairs and replacements are made; and the producing power of the plant should be increased if, instead of amortizing capital, replacement of values lost through composite depreciation is made by the purchase of additional plant.

There are other reasons why an old plant should possess a larger earning power than a new one, such as adaptability and smoothness of operation. These are also additional reasons for distinguishing between efficiency and depreciation.

CHAPTER IV

GENERAL ACCOUNTING PRINCIPLES

Same Principles Applied

The same principles are employed in handling depreciation as are necessary in accounting for other financial transactions and facts. This involves the usual charges and credits, transfers and combination, with which the student of accounting is familiar. The problems to be solved arise out of the nature of modern industry and organization. Let us review briefly the elements entering into the makeup of an industrial plant.

Constituents of Plant Value

For a time a new enterprise exists by consuming a part of its own capital, although normally the cost of existing is met out of income. Consequently, the investment represents more than the prime cost of the units of which the plant is composed. There are also expenditures which are not made for tangible assets. These expenditures, when applicable to specific tangible assets, should be considered as a part of the cost thereof, while expenses of a more general character should be charged to a separate account, such as Capitalized General Expenditures. Such costs arise from the various preliminary and incidental costs of construction—surveys, legal aid, insurance, taxes, interest on capital, alterations of plans, and so on. Ordinarily such expenditures are charged to revenue, but, during construction, as well as for a time thereafter, sometimes called the "educational period," they are properly capitalized.

Omitting details, industrial plant is of a threefold character, as follows:

1. Plant, therein being all direct costs, real estate, right of way, etc., with a percentage added for overhead.
2. Equipment, a direct cost to which nothing need be added for overhead except possibly a small percentage for installation.
3. Capitalized general expenditures, including legal services, insurance, taxes, etc., incurred during construction and, usually, for a time thereafter.

As explained above, capitalized general expenditures are of such a general character that they are not applicable to definite subdivisions of plant. They are in the nature of indirect or overhead costs, and if not ascertainable from vouchers are estimated as a percentage on direct cost of construction of plant and equipment.

Direct Costs

All costs of plant and equipment applicable to specific units should be charged direct to them in the accounts. As noted, something more than prime cost is thus included; for all overhead, except that of a general character which cannot be charged direct because it is incident to the whole plant, should be included therein.

Intangible Costs

The chief intangible costs are discussed in the following paragraphs:

ENGINEERING.—Engineering cost differs with the enterprise and the locality. It is usually in the neighborhood of 5 per cent of the direct cost of construction of railroads. This percentage was assumed in a recent valuation of the Lehigh Valley Railroad. But construction cost, in accordance with the Interstate Commerce Commission's requirements, does not include cost of land for road-bed or other purposes. In engineering costs are included salaries of engineers and assistants, their traveling expenses, and the cost of instruments used.

In an investment of $26,736,000 in the Metropolitan water works, Boston, 7.77 per cent represented engineering expenses, preliminary and constructional. Of the disbursements on the New York water works to the end of September, 1913, 9.78 per cent of the total, or $10,050,000, was for engineering; but costs of extensive borings and investigations were here included. In the Boston subways the engineering cost ranged from 5.05 to 9.88 per cent of total cost, varying in different divisions (1895-1912). In the Kennebec new gravity water supply it was 6.69 per cent of total cost (1906); in the Louisville sewerage works, 9 per cent (1906-1912); in the Springfield, Massachusetts, water works, 10 per cent (1910); and in the Springfield, Massachusetts, Ludlow filters, 17 per cent (1906). These figures are presented merely to convey some idea of the portion of total cost represented by engineering expenses.

Promotion.—The preliminary expense of financing an enterprise is always considerable. Surveys may be necessary to determine the feasibility of a proposed site. Consent of landowners in the form of options may be necessary. Legal, engineering, and financial experts are consulted. If reports warrant, a charter of incorporation is obtained, securities are sold, land is bought, final surveys are made, and plans for the proposed works completed.

Insurance During Construction.—The cost of insuring property during construction and until the plant is placed on a going-concern basis should be charged to this account, not as expense, but as investment. During the period of construction a certain amount of the property is inevitably destroyed by accident or otherwise. For the same reason that insurance is a legitimate expense in a going concern its cost during construction is a part of the investment.

INTEREST DURING CONSTRUCTION.—This item of cost requires careful consideration. Money required must be secured sufficiently in advance of the time when needed to avoid any temporary lack of funds and consequent suspension of work. Therefore interest must be paid on the money for a considerable time previous to its disbursement, as well as afterwards, and at a higher rate than can be obtained by placing money in banks until needed.

Interest cost during construction is frequently computed as equivalent to the interest on total cost of construction (not including interest) for one-half the construction period. This method is based on the assumption that the rate of expenditure remains constant from the inception to the completion of the work and that interest is incurred on money only after it is disbursed.

A constant rate of expenditure on plant would, however, be exceptional. At times it is greater, at times less, than this assumption implies. During the first half of the construction period, when most of the materials are purchased, it is usually greater than in the latter half, so that there is a greater interest cost than the foregoing assumption implies. Interest during construction is a capital expenditure quite as much as is the prime cost of machinery and buildings.

DEVELOPMENT COSTS.—Some time may intervene between the completion of construction and the point when the business reaches a profitable basis. During this period the expenses of an operating concern are incurred but are paid out of capital, in part at least. Investments in construction now cease largely or altogether, but current expenses and interest continue and add an additional item to investment. As revenues increase an increasing part of such costs are paid out of income and sooner or later the enterprise must become self-sustaining.

Preservation of Capital—Protection of Investments

If the plant is a public utility it is subject to commission regulation; it probably possesses a monopoly of the market, and to that extent is free from competition. If it is a private corporation no commission intervenes, but the consumer protects himself by bidding in the open market. In any case its prosperity is influenced by various and diverse interests. When the sole proprietor directly supervised his own property he had every incentive to husband it with care. Today, however, the owner of wealth is oftentimes deprived of its control; but since ownership implies right of enjoyment and continual possession, the investor trusts to the integrity of other men—whether they be corporation officials or members of public service commissions.

Good accounting is based upon the distinction between capital and revenue. The integrity of all investments depends upon this principle. Unless it is adhered to, investment and income are obscured; and as a result capital is frittered away as dividends and the financial foundations of the enterprise are weakened. The investment must be kept undiminished by providing for its renewal wherever it leaks away as the result of unavoidable losses. We shall now consider the general accounting procedure necessary to make good losses arising from depreciation, leaving to later chapters the consideration of the various refinements of that subject.

Balance Sheet of a New Enterprise.—Assume the following balance sheet to represent the condition of Company A, a new corporation organized to engage in the manufacture of some commodity:

BALANCE SHEET OF COMPANY A, AS AT......

Factory Building	$100,000	Capital Stock............	$160,000
Machinery	25,000		
Other Assets	35,000		
	$160,000		$160,000

This balance sheet has been reduced to the simplest terms to avoid unnecessary details. The only assets subject to depreciation are the factory building and the machinery. Let us assume that the factory building will require replacement at the end of fifty years and the machinery at the end of twenty-five years. This means that if equal amounts of depreciation occur in equal periods of time there occurs each year a deterioration of $2,000 in the building and $1,000 in the machinery. This depreciation, amounting to $3,000, is one of the costs of production, as much as is cost of fuel and labor. It is peculiar, however, in this respect, that it was paid for when the building and the machinery were paid for, so that during the first year and those which follow no expenditure appears to be necessary beyond minor repairs. The operations of manufacture perhaps increase in efficiency, so that the output increases also.

HOW BALANCE SHEET CHANGES.—Suppose that the management neglects to make any allowance for this depreciation of buildings and machinery and that at the end of the first year's operations the profit and loss account shows a profit of $15,000. Acting on the belief that this is net profit the management pays it to the stockholders as dividends. This process continues year after year until twenty-five years have passed, when the machinery must be replaced. Assuming that no essential changes have taken place in the balance sheet and that new machinery can be bought at the same cost as that of the old machinery, and neglecting the question of salvage, the management is now faced with the problem of securing $25,000 with which to buy machinery. Its "Other Assets," amounting to $35,000, cannot be converted into cash for that purpose because they are needed in their present status. It therefore becomes necessary to borrow $25,000 at, say, 5 per cent to make the replacement, after which the balance sheet appears thus:

Balance Sheet of Company A, as at......

Factory Building	$100,000	Capital Stock	$160,000
Machinery	25,000	Notes Payable	25,000
Other Assets	35,000		
Deficit	25,000		
	$185,000		$185,000

By failing to make allowance for depreciation of machinery, a deficit of $25,000 has been incurred and the enterprise has been saddled with a fixed charge of 5 per cent on $25,000, or $1,250. In reality the situation is far worse than appears in the balance sheet, because the useful life of the factory building is one-half expired. A further deficit of $50,000 is hidden in this account. Passing over another 25-year period we find that both building and machinery now require replacement at a cost of $125,000. Since no reservations have been made it is necessary to borrow, after which the balance sheet appears as follows:

Balance Sheet of Company A, as at......

Factory Building	$100,000	Capital Stock	$160,000
Machinery	25,000	Notes Payable	150,000
Other Assets	35,000		
Deficit	150,000		
	$310,000		$310,000

The concern now has a deficit of $150,000, or nearly the whole amount of the investment, and a fixed interest charge of 5 per cent on $150,000, or $7,500. The equity remaining is $10,000, which means that of the original investment of $160,000 all but $10,000 has been lost. The yearly depreciation cost of $2,000 on building and $1,000 on machinery, or a total of $3,000 for fifty years, accounts for this. The assumed profit for the first year was $15,000. The real profit was $15,000—$3,000, or $12,000. Now, however, assuming that the returns continue unchanged year after year, $7,500 of this must be used to pay interest on borrowed money and it is very evident that a continuation of this policy will result inevitably in bankruptcy.

Of course conditions do not actually recur with the same regularity that we have assumed, nor are they as simple; yet this does not affect the general applicability of our illustration. That financial embarrassments and bankruptcies do frequently result from a neglect to recognize the truth about depreciation is not to be doubted. Too often the cost of depreciation is forgotten in the presence of more noticeable but not less important demands.

THE CORRECT POLICY—VALUATION RESERVES.—Let us suppose that a correct depreciation policy is pursued. Such a policy always rests on the principle that depreciation is a current cost of production. Such cost or burden may be distributed equitably among accounting periods by a procedure which is simple in principle.[1] It is best accomplished by means of "valuation reserves." Overlooking the fact that it is desirable in practice to charge depreciation monthly, we shall here proceed on a yearly basis. At the end of the first year the following entry is made in the journal:

Profit and Loss	$3,000	
To Reserve for Depreciation of Building		$2,000
Reserve for Depreciation of Machinery		1,000
To charge Profit and Loss with the year's depreciation expense.		

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[1] The further distribution of depreciation cost to output is a problem in cost accounting, considered in Chapter VI.

Purpose of Reserves.—Such reserves are called "valuation reserves," because of their peculiar relation to the assets whose depreciation they measure. They evaluate these assets in the sense that they show what part of their cost has been consumed by depreciation. The debit may not always be to profit and loss. It may be a proper charge to the manufacturing section of the income account, in which case in the subordinate cost records it is shown distributed over the various jobs as a manufacturing cost. At any rate the charge is always made to a nominal account while the credits are posted to real accounts in the ledger, whose titles correspond with those given in the journal entry. Although their credit balances remain open from fiscal period to fiscal period they represent neither liabilities nor capital, as do the majority of real accounts which show balances on the credit side. Their sole purpose is to record accrued depreciation and to make it possible at the same time to retain in the ledger the cost of the assets whose depreciation they record.

Were it not considered desirable to keep this separate account for depreciation, the following entry, not infrequently made, would serve:

Profit and Loss	$3,000	
To Building		$2,000
Machinery		1,000

The ultimate effect of either entry is the same, but to credit the fixed assets each year or month with the amount of their accrued depreciation leads to certain difficulties that can be avoided by the use of valuation reserves. The convenience of the reserves will soon appear.

Effect on Balance Sheet.—The A Company now pursues the conservative policy of charging revenue and crediting depreciation reserves each month or year, and as a consequence the balance sheet at the end of twenty-five years, when the machinery requires replacing, appears as follows:

BALANCE SHEET OF COMPANY A, AS AT......

Factory Building.........	$100,000	Capital Stock............	$160,000
Machinery...............	25,000	Res. for Depr. of Bldg....	50,000
Other Assets.............	110,000	Res. for Depr. of Mach...	25,000
	$235,000		$235,000

This is the way the balance sheet appears on the assumption that all net profits were distributed; but whereas under the defective policy of not accounting for depreciation this distribution amounted to $15,000 per annum, it is now only $12,000. The building has passed one-half of its useful life and has depreciated $50,000. The machinery is ready to be replaced. Now note that although no special cash fund appears for the purpose of making this replacement, or that of the building when later it must be replaced, the account, Other Assets, has increased from $35,000 to $110,000, or $75,000, which is the amount of depreciation shown by the two reserves on the credit side. This means that the management has retained either cash or other assets sufficient in amount to cover the depreciation which has occurred in the building and the machinery. It might not be desirable to keep this in the form of cash, although care should be taken that the cash will be forthcoming when needed. Even if it becomes necessary to borrow, however, that may not be bad policy.

HOW REPLACEMENTS ARE MADE.—Thus if it has been found desirable to tie up most of the $110,000 in one form or another of property other than cash, it may be found convenient to borrow on a note the $25,000 necessary to replace the machinery. This is accomplished, the old machinery is abandoned, and the new machinery installed. Neglecting minor details, these transactions may be shown thus:

Cash	$25,000	
To Notes Payable		$25,000
For loan to make replacement.		
Reserve for Depreciation of Machinery	25,000	
To Machinery		25,000
To write off old machinery.		
Machinery	25,000	
To Cash		25,000
For purchase of new machinery.		

The balance sheet now stands thus:

BALANCE SHEET OF COMPANY A, AS AT......

Factory Building	$100,000	Capital Stock	$160,000
Machinery	25,000	Res. for Depr. of Bldg.	50,000
Other Assets	110,000	Res. for Depr. of Mach.	00
		Notes Payable	25,000
	$235,000		$235,000

Notice that in this instance the loan has been obtained without causing a deficit. This is because the old machinery was written off against its corresponding valuation reserve, whereas in the previous illustration there was no reserve and it was necessary to write the old machinery off against the capital account. Whether it is better to borrow or to manage to have sufficient cash on hand to avoid borrowing is a question of policy to be determined by the circumstances. When the business is expanding there is no doubt but that additional capital should be secured by loans or the issuance of stock. If it is not growing it will perhaps be found easier to make reservations of cash than if it is growing. Our illustration is misleading in that it shows but two great classes of replacements made at intervals of twenty-five and fifty years, respectively, whereas in practice they are spread more uniformly from year to year and the question of securing needed cash is then obviously less difficult.

Depreciation Reserve in Balance Sheet.—In the opinion of the writer it is better to show the depreciation reserve in the balance sheet as a deduction from the asset which it evaluates than to list it on the liability side. When the balance sheet shown on page 76 is thus arranged, it appears as follows:

Balance Sheet of Company A, as at......

Factory Building	$100,000		Capital Stock	$160,000
Less: Res. for Depr.	50,000	$ 50,000	Notes Payable	25,000
Machinery		25,000		
Other Assets		110,000		
		$185,000		$185,000

This brings the valuation reserve into juxtaposition with the asset which it evaluates and tends to make the balance sheet more easily understood by the person not skilled in accounts.

Extensive Plant and the Composite Depreciation Reserve

In practice there occur several variations which the simple illustrations given above do not cover. Some forms of business require large sums of capital to be invested in a great number and variety of assets. Railroads afford an illustration. The tracks, rolling stock, buildings, and other assets which comprise its material equipment are so extensive and varied that the cost of making replacements tends toward uniformity from month to month and year to year. Under such circumstances we may ask: What is the necessity of any depreciation reserve at all? If the purpose of the depreciation reserve is to secure uniformity of replacement cost then there is no need for such a reserve. But its purpose is not that; indeed replacement cost cannot be made any more uniform from month to month with a depreciation reserve than without it. The purpose of the depreciation is to bring the effects of depreciation expense into the accounts in such a way that it will be charged as it occurs. It is not the purchase of an article which justifies charging it to the consumer but its use in producing something which he buys. Now depreciation expense occurs during the useful life of an article, not when it is replaced; and that expense should be charged as it occurs, not after the article is abandoned and a new one purchased to replace it. No single error has caused more misunderstanding than the confusion of replacement cost with depreciation expense. If it were made a general policy to charge for an article used for productive purposes only when replaced and this policy were carried to its logical limit we should soon come to the point where the industrial world would be behind on all charges for depreciation expense by the amount of the time represented by the useful life of its material equipment; and not those who benefit from the depreciation, but those who follow them, would be charged with it. If the principle that depreciation, and not replacement, is what constitutes the expense arising from the employment of wasting assets in production is to be abandoned, the whole literature of cost accounting should be scrapped.

EFFECT OF TIME.—Accepting the proposition that the depreciation reserve is a necessity in case of extensive plant, how will it be affected by progress of time and the constant series of abandonments charged against it? This may be illustrated as follows:

A railroad consists of assets having useful lives ranging from comparatively short periods to, let us say, 100 years. Ties, we may assume last, on an average, 7 years, freight cars 15 years, locomotives 20 years, steel bridges 50 years, and so on. Suppose that as soon as operations begin a system of accounts is installed which writes off depreciation as expense over the lives of the various classes of physical assets. It is clear that during the first ten or twenty years of the existence of this railroad the reserve will grow continually greater because replacements of extensive and more expensive types of equipment will not begin on a large scale until after fifteen or twenty years have expired. After that time replacements will become heavier and in time entirely counterbalance credits to the reserve; so that the reserve will remain about stationary and represent the amount of partial depreciation existing in the various parts of the system at all times. This may be called the condition of normal depreciation. For questions arising as to the usefulness of this reserve later chapters should be consulted. When replacements cost more than the original, it is an added investment, not really a replacement.

Salvage and Scrap

We have assumed that total expiration of usefulness results from depreciation. Usually, however, either a salvage or a scrap value remains,[2] and in a given cycle of usefulness [3] the depreciation charge is based not on cost but on cost less salvage or scrap value.

Enterprises of Limited Life

Some forms of undertakings, particularly those organized for the exploitation of mineral deposits, are established with the specific understanding that replacements of plant are not to be made larger than is necessary fully to exploit the deposits. Such cases require a different form of procedure.[4]

Twofold Purpose of Depreciation Accounting

Present-day practice shows a lack of unanimity of opinion upon the use of the words "reserve" and "fund." Not only are they used loosely, but interchangeably. Some writers have explained their correct use, but in practice little uniformity exists. A variety of conditions renders the employment of reserves beneficial, also funds. Bad debts, contingencies, accommodation paper, bonded indebtedness, depreciation, etc., admit of their useful application.

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[2] For definitions of these terms, see p. 50.

[3] See p. 52.

[4] See pp. 87-89.

That depreciation is an expense and that one of the purposes of making the charge is to reflect actual conditions in the books of account has been explained. Another purpose of depreciation accounting is to provide directly or indirectly the money required to make the replacement of worn-out or abandoned parts of plant. These two objects are quite distinct and must not be confused.

Reserves and Funds Distinguished

Although the depreciation reserve preserves invested capital by the retention of revenue, future replacements will be made out of general funds unless some special provision is made to accumulate money for that purpose. A fund designated for a definite purpose is not necessarily inviolable, but it possesses a definite status and is less likely to be misdirected than money not specially earmarked.

To illustrate, Corporation X owns a factory building which cost $50,000 and has an estimated useful life of thirty years. Each year the depreciation reserve is credited with $1,000 and depreciation expense charged. At the end of the first year the balance sheet appears thus:

BALANCE SHEET OF COMPANY X, AS AT......

Factory Building	$ 50,000		Capital	$100,000
Less: Res. for Depr.	1,000	$ 49,000	Dividends Payable	2,000
Other Assets ...		53,000		
		$102,000		$102,000

Capital is preserved by this procedure, for had no depreciation charge been made the balance sheet would be:

BALANCE SHEET OF COMPANY X, AS AT......

Factory Building	$ 50,000	Capital	$100,000
Other Assets	53,000	Dividends Payable	3,000
	$103,000		$103,000

and after payment of dividends:

BALANCE SHEET OF COMPANY X, AS AT......

Factory Building	$ 50,000	Capital	$100,000
Other Assets	50,000		
	$100,000		$100,000

which makes no allowance for the depreciation which has accrued.

The retention of sufficient funds, by means of the depreciation charge, is the essential step. If these remain a part of the general funds they are reinvested and perhaps give rise to no further special consideration. Further attention is necessary, however, if we wish to keep these funds separate.

DEPRECIATION FUNDS.—Funds created for the replacement of buildings, machinery, etc., are not, it is true, controlled by contract obligations; consequently the management retains full power over them. The same formulas that are employed to compute payment to a sinking fund may be applied to depreciation funds, although as a matter of policy interest may be handled differently in the two cases. If securities of other corporations are purchased for the depreciation fund, it may be convenient to add the revenue derived therefrom to general income instead of adding it to the fund. As a rule industrial corporations are not as well prepared to look after investments as are sinking fund trustees and consequently income from the funds in their control can be employed more productively in the business.

FORMATION OF THE RESERVE.—In later chapters several formulas are considered for finding the sums that must be set aside to accumulate in a given time to a given amount. Two of these formulas are given below. If equal instalments are allowed to accumulate at compound interest, the formula is as follows, x representing the amount to which the fund is to accumulate, r the rate of interest plus 1, and n the number of years to run:

$$x = \frac{v(r-1)}{r^n-1} \tag{1}$$

Logarithms can be used to solve the formula if the term of years is large because of the difficulty of raising r to the nth power by multiplication.

If interest is not added to the principal, the amount of each instalment is determined thus:

$$x = \frac{v}{n} \tag{2}$$

In this formula, v is the sum accumulated after n years by paying equal instalments, x, into the fund.

Taking the simpler case first, if Corporation Y wishes to establish a replacement fund for a building costing $25,000 with an estimated life of twenty-five years, by application of formula (2) we find, ignoring salvage, the amount of each instalment to be $1,000, thus:

$$x = \frac{25{,}000}{25} = 1{,}000$$

Assuming that each year's depreciation amounts to $1,000, this is brought into the books by this entry:

Profit and Loss (or Depreciation)	$1,000	
To Reserve for Depreciation of Building		$1,000
For depreciation accrued.		

FORMATION OF THE FUND.—Next, having decided to establish a depreciation fund for replacement of the building, and having found a suitable manner in which to invest the $1,000, the following entry is made:

Depreciation Fund for Building	$1,000	
To Cash		$1,000
For investment of cash in a depreciation fund.		

·The balance sheet then appears:

BALANCE SHEET OF COMPANY Y, AS AT......

Buildings	$25,000	Capital	$50,000
Other Assets	25,000	Res. for Depr. of Bldg.	1,000
Depr. Fund for Bldg.	1,000		
	$51,000		$51,000

or, better still:

BALANCE SHEET OF COMPANY Y, AS AT......

Building	$25,000	Capital	$50,000
Less: Depr. Res.	1,000		
	$24,000		
Other Assets	25,000		
Depr. Fund for Bldg.	1,000		
	$50,000		$50,000

If no depreciation fund is established the balance sheet stands thus:

BALANCE SHEET OF COMPANY Y, AS AT......

Building	$25,000	Capital	$50,000
Less: Res. for Depr.	1,000		
	$24,000		
Other Assets	26,000		
	$50,000		$50,000

When a depreciation fund is carried, at the expiration of twenty-five years the depreciation reserve has grown in amount equal to the original cost of the building, and the replacement is shown by the following entries:

Cash	$25,000	
To Depreciation Fund for Building		$25,000
For sale of depreciation fund investments.		
Building	25,000	
To Cash		25,000
For construction of new building.		

Although an equal degree of simplicity is not possible in practice, yet the principles apply subject to adjustments for salvage, variations from anticipated life of assets, etc.

INTEREST AS A FACTOR.—If interest is added to principal in computing the fund, the computation is somewhat more complicated. Suppose Corporation Y possesses a building the cost of which is $100,000 and the estimated life ten years. A replacement fund is to be established to accumulate at compound interest, 4 per cent being the assumed rate. Applying formula (1)[5] the annual instalment is found thus:

$$x = \$100{,}000 \times \frac{1.04 - 1}{1.04^{10} - 1} = \$8{,}329.09$$

which is carried to the depreciation fund by the same procedure as in the preceding illustration. As interest is received on the investments in the depreciation fund it is suitably invested, the following entries being necessary to bring the transaction into the books:

Cash	$........	
To Reserve for Depreciation		$........
Being interest received on depreciation reserve investments.		

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[5] See p. 82.

Depreciation Fund for Machine........ $........
To Cash .... $........
To record transfer of cash to the special depreciation fund for machine.

Terminology

The terminology may be altered from that used in the foregoing explanation without changing the principle involved. Thus in railroad accounting the depreciation reserve is technically known as the "Reserve for Accrued Depreciation," and in the balance sheet it is deducted from "Road and Equipment." Under the Uniform System of Accounts for Telephone Companies presented by the Interstate Commerce Commission, "Depreciation of Plant and Equipment" is charged and "Reserve for Accrued Depreciation" credited for the amount of depreciation accruing on tangible fixed capital, while in the account prescribed by the Interstate Commerce Commission for gas and electric corporations in the District of Columbia "General Amortization" is charged and "Accrued Amortization of Capital" is the reserve or credit account. More illustrations might be given showing still other variations in terminology, but since the object attained is always the same, this is unnecessary.

Advisability of Creating Funds

It may not be desirable to accumulate depreciation funds; it is the author's opinion that as a general rule specific funds are not necessary. The Interstate Commerce Commission rejects the use of depreciation funds for railroad accounting although it considers them useful under some conditions. Character of plant determines the method of financing renewals and replacements. Sometimes in making extensions to property there is no objection to borrowing money temporarily from the depreciation fund. This should, of course, be returned to the fund when money intended for the extensions is secured.

A Study of Balance Sheets

A study of twenty-two balance sheets given in recent reports of large American corporations shows great lack of uniformity in the management of reserves and funds. A fair proportion of these concerns show reserves either as liabilities or as deductions from assets. Few indicate special funds, except sinking funds for the redemption of bonded indebtedness. The United States Steel Corporation balance sheet has an account on the asset side entitled "Sinking and Reserve Fund Assets." The Philadelphia Rapid Transit Company balance sheet shows "Reserve Fund for Renewals" on the asset side, and on the liability side, of equal amount, "Renewal Reserve." The balance sheet of the Third Avenue Railway Company has an account on the asset side entitled "Deposit for Depreciation, Renewals, and Contingencies," and on the liability side, "Reserve for Depreciation, Renewals, and Contingencies." The Pittsburgh Brewing Company has a "Plant Sinking Fund" among the assets.

Sinking funds receive equally diversified names. The International Paper Company has "Sinking Fund Accounts"; the United Gas Improvement Company, "Sinking Fund Securities"; the Interborough Rapid Transit Company, "Sinking Fund on 5 Per Cent, 45-Year Gold Mortgage Bonds"; and the Bethlehem Steel Corporation, "Special Funds in Hands of Trustees for Redemption of Mortgages."

The following companies indicate the depreciation reserve on the right-hand side: Philadelphia Rapid Transit Company, Third Avenue Railway Company, Tennessee Copper Company, Interborough Rapid Transit Company, and Bethlehem Steel Corporation.

Sears, Roebuck and Company and the Lehigh Valley Railroad Company show the reserve as a deduction from the assets. The report of Wells, Fargo and Company as of June 30, 1912, indicates "Reserve for Accrued Depreciation" deducted from property and equipment account, whereas the report for the preceding year lists it on the liability side—an indication of progress.

The Utah Copper Company balance sheet shows an account on the liability side entitled "Appropriated Surplus—Sinking Fund"; while the balance sheets of William Cramp and Sons, the Baldwin Locomotive Works, the International Harvester Company, the General Electric Company, the American Tobacco Company, and the Amalgamated Copper Company, indicate neither reserves nor funds of any kind.

These facts indicate a lack of uniformity, justifiable, perhaps, to a certain extent. Clearness in the balance sheet is, as a rule, aimed at; but in some cases it is difficult to believe that such is the intention. The balance sheet ought to reflect, not obscure, conditions. The proper tabulation therein of the depreciation reserves and funds is of much assistance to a clear and consistent presentation of facts.

Principles Applicable to Mining Companies

The following quotation from the report of the committee of the National Coal Association on a standard system of accounting and analysis of cost of production illustrates the most approved procedure for concerns engaged in exploiting natural resources:

> After a coal mine has been developed and equipped to its planned output capacity, charges to its Capital Account should cease, and thereafter there will be few if any permissible charges to that account.
>
> Usually after one-third or one-half the life of the mine has elapsed, and from time to time thereafter additions to power plant and major items of equipment will be necessary, and the Cost thereof should be set up in appropriate Additions and Betterment Accounts, and for these will have to be established an additional and separate depreciation rate based on the remaining coal or life of the mine.

At the end of each month, Operating Account should be charged, and Depreciation credited with an amount equivalent to the depreciation rate multiplied by the number of tons mined during the month. At the end of the year Depreciation should be charged with the year's accumulation and the respective elements of the mine written off in proper proportions. If, however, the operator prefers to allow total Depreciation to stand as a credit on the ledger, it should in the Balance Sheet be exhibited as a deduction from the cost of property. Irrespective of which way it is handled on the General Ledger, the proper reducing entries should be made against each element of the property in the Plant Ledger.

In the case of mines operated under lease, if the leasehold rights run longer than the probable period required to exhaust the estimated available coal, the same factor of Depreciation applies; but if the life of the lease is shorter than the probable period required to get all the coal, the monthly charge to Operating Account and corresponding credit to Depreciation should be such proportion of the cost of the mine as one month is of the remaining term of the lease.

Funds representing Depreciation accumulations, if not periodically applied to the retirement of outstanding securities or obligations, should be kept liquid for that purpose or invested in assets distinct from the depreciating property.

Before any profit or net income can be realized, current expenses for labor and for material consumed, current repairs, replacements and depreciation must be made good out of gross income.

Hence, sound consideration of the nature of investment in coal mining or any other wasting industry dictates that all outlay must be classified and dealt with as follows:

(a) The initial cost of the mine in its entirety, chargeable to Capital Account—and which must be redeemed by periodically setting aside, from current gross income, sufficient amounts to replace such investment within the life of the mine. It is obvious that the fund thus derived must be held inviolate for ultimate capital redemption, and if not applied immediately to the retirement of outstanding securities, invested in assets separate from the depreciating property or kept liquid in the business.

(b) The cost of Additions and Betterments, so large that such costs should be capitalized, must likewise be redeemed by setting aside from gross income adequate provision for reimbursing such cost during the life of the mine.

(c) To ordinary Operating Expense should be charged the cost of repairs and replacements of plant and equipment, and also cost of additional equipment necessary because of the extension of workings to maintain the normal output.

CHAPTER V

PLANT ANALYSIS AND THE PLANT LEDGER

In practice the depreciation problem can be adequately handled only by first making an analysis of the units of which such a plant is composed, based upon their use, value, and longevity. In this chapter such an analysis will be made of a hydroelectric plant for the purpose of affording an illustration and to serve as subject matter for further discussion of the question of method in caring for depreciation.

Definition of a Unit

The word "unit," as used in this chapter, will be understood to mean a subdivision of plant, consisting of one, a few, or even many items, as determined by a consideration of use, value, and longevity, the unit in each case being the most suitable portion of plant to employ as a basis for figuring depreciation. Thus a unit may be a building, or twenty locomotives of similar class, or a steamboat, or the hulls of ten similarly constructed steamboats, and so on, the question being always one of expediency and determined upon the actual conditions. The following rules may be of assistance:

1. A unit of plant cannot be made up of unlike things, or things having different functions.
2. For the sake of the saving in calculations, a unit should include as many items as possible capable of being handled together.
3. A number of things may be handled together as a unit if they have the same general physical makeup, are employed for the same purpose, and, what would be ordinarily inferred from the foregoing, have approximately the same lifetime.

Thus a number of locomotives of a given type would form one unit, steel rails of a given weight another, station house of a given structure another, water wheels of a certain pattern another, and so on.

Analyzing Cost of Industrial Plant

A plant generating electricity may be run by either steam or water power. The fixed charges on a steam plant being much greater than on a water power plant, the economy of the latter makes it desirable when conditions are such that its use is possible. Following the general classification of plant values given on page 67, the component parts of a hydroelectric plant may be subdivided as follows:[1]

TABLE I. SUBDIVISION OF COST OF INDUSTRIAL PLANT

		Proportional Cost %
I. Plant:		
(a) Riparian rights for dam and flowage basin, real estate expenses, organization expenses, preliminary legal expenses, cost of financing, removal of railroads, highways, bridges, and all expenses preliminary to actual construction of work		20
(b) Permanent construction, dam, power house and waterways, etc.		30
(c) Transmission system:		
(1) Right of way	4.5	
(2) Copper	1.5	
(3) All else	7.0	13
II. Equipment:		
(a) Equipment of power house		14
III. Capitalized General Expenditures:		
(a) General expense, engineering administration, legal, etc.		11
(b) Interest during construction		12
		100

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[1] The data on hydroelectric plant used in this chapter are taken from the discussions of Calvert Townley and Dr. Cary T. Hutchinson, before the American Institute of Electrical Engineers, Dec., 1909.

Of these items only I(b), I(c), and II(a), comprising 57 per cent of the entire cost of the plant, are subject to depreciation, and of item I(b) a large part does not depreciate to any appreciable degree from physical causes, since it covers rock excavation and concrete.

Table 1 indicates the proportional cost of the main subdivisions of the plant. Thus the cost of the equipment is 14 per cent, and of the transmission system 13 per cent, of the total cost of the plant. Tables 2 and 3 indicate what percentage the cost of the different units of equipment and transmission system is of the total cost of the equipment and transmission system, respectively.

ANALYSIS OF TRANSMISSION SYSTEM.—For illustrative purposes our attention will be confined to items I(c) and II(a), since they will serve to indicate the effects of both functional and physical depreciation. The following table classifies the units of the transmission system—I(c)—indicating the proportional cost of the units and their lifetime in years. In this connection it may be well to repeat that by "unit" is meant one, or more than one, item of plant, as has already been explained.

TABLE 2. COST AND LIFETIME OF TRANSMISSION SYSTEM

1. TRANSMISSION LINE

		Proportional Cost %	Life in Years
I-c-1	Right of way	45.0	..
I-c-2	Towers	18.4	15
I-c-3	Special structures	5.1	10
I-c-4	Insulators	2.1	10
I-c-5	Copper	23.7	25
I-c-6	Installation	5.7	..
		100.0	

2. SUBSTATIONS

		Proportional Cost %	Life in Years
I-c-7	Land	6	..
I-c-8	Buildings	30	25
I-c-9	Transformers	40	20
I-c-10	Switches, etc.	16	10
I-c-11	Installation	8	..
		100	

ANALYSIS OF POWER HOUSE EQUIPMENT.—The equipment of power house is classified in the following table:

TABLE 3. COST AND LIFETIME OF POWER HOUSE EQUIPMENT

		Proportional Cost %	Life in Years
II-a-1	Stop logs, gates, and other wood exposed to air and water	0.80	5
II-a-2	Flooring, roofing, hardware, and miscellaneous fixtures	9.80	15
II-a-3	Tile wainscoting, sewage, plumbing system, metal window frames, etc.	2.45	15
II-a-4	Electric light and telephone	0.80	10
II-a-5	Switchboard equipment	4.35	10
II-a-6	Cables and heavy wiring	3.90	10
II-a-7	Cranes	1.25	15
II-a-8	Water wheels	33.75	25
II-a-9	Water wheel governors	2.90	10
II-a-10	Generators and transformers	40.00	25
		100.00	

Relation of Unit Cost to Investment

If the cost of the entire plant is known, the cost of any unit can easily be derived by first finding what percentage the chief subdivision of which the unit forms a part, is of the cost of the plant, and taking this percentage of the entire cost of the plant. When the value of the chief subdivision is thus found, the value of the unit may then be determined by finding what percentage the unit is of the chief subdivision.

To illustrate, if the cost of the entire plant is $100,000, then the cost of the power house equipment is 14 per cent of that amount, or $14,000, and the cost of any of the units composing the power house may be found by multiplying $14,000 by the percentage of the cost of equipment represented by it. Thus the cost of the water wheels is .3375 of $14,000, or $4,725. These percentages must, of course, be based upon the actual cost of the properties.

Character of Plant Ledger

The plant ledger should be made an essential part of the double-entry books, and be controlled by a Plant account in the general ledger with which it must be in agreement. The form and arrangement of the plant ledger should be such as to combine brevity, accuracy, and compactness with the necessary amount of detail. It should afford a complete record of the life of each unit or class of units of the plant.[2] In determining what shall be considered a unit or class of units, an analysis of plant similar to that in the preceding sections of this chapter should be made.

The plant or property ledger must show not only the original investment in a unit of plant, but also in all additional units of a like character afterwards purchased. It must show as well the losses sustained each year on all wasting assets and their resultant diminished value. If desirable, the month may be made the time basis for figuring depreciation, but in most cases the yearly basis will be sufficiently accurate, and is employed in the following illustrations. The plant ledger should also be so arranged that all needed adjustments, either to show the effect of functional depreciation, or that of an unanticipated shortening or lengthening of a unit's life, can be made.

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[2] The Bureau of Internal Revenue prescribes that in charging off depreciation: "The allowances should be computed and charged off with express reference to specific items, units, or groups of property, each item or unit being considered separately or specifically included in a group with others to which the same factors apply. The taxpayer should keep such records as to each item or unit of depreciable property as will permit the ready verification of the factors used in computing the allowance for each year for each item, unit, or group." (*Reg.* 62, Art. 169.)

Description of Plant Ledger

A loose-leaf book is most suitable for the plant ledger, because it is unnecessary to carry in it more pages or sheets of paper than are needed for current work, and additions can be made when required. Forms 2 to 4 represent pages of the plant ledger. An explanation of the data entered in these forms is given below.

In the plant ledger the pages or sheets used for the record of any unit or class of units should be numbered consecutively to prevent confusion. The name of the unit appears in the upper left-hand corner. The year of installation of a new unit, or of adjustment of an old one, appears in the first column. In case of an old plant it indicates the year the plant ledger was installed. In the next column is entered the estimated life (or remaining life) of the unit, and in the third column its value at time of installation. In the remaining columns the annual depreciation allowances are distributed, their total equaling the cost or adjusted value of the unit, as given in column three, the element of scrap value not being taken into consideration.

The first distribution column of any particular unit should correspond in date with the year of installation of the property. Approximate accuracy will be secured if for the first year the distribution allowance be calculated as one-half that of a full year, since the installations will be fairly well scattered through it, some going into operation early, others late, in the year.

If a number of items of a class are installed at different times during the year, or if there may be uncertainty as to whether the installations for the year in any particular class are completed, an auxiliary blank should be used from which at the close of the year a recapitulation can be made and the total installation entered in the plant ledger. In this way one line serves for each year's installations of any class, and the work of computing the annual allowances and possible future adjustments is reduced to a minimum.

Use of Plant Ledger

To illustrate the working of the plant ledger, we may take the hydroelectric plant analyzed in the preceding pages, assuming its total investment value to be $100,000, and selecting one of its units. For example, let us take item 9 of power house equipment, "Water Wheel Governors," having an estimated life of ten years, and comprising 2.9 per cent of the value of the equipment, or $406. Assuming the installation to have been made in the year 1912, the entry for it in the plant ledger is shown in Form 2. As, according to our assumption, but one-half of a full year's depreciation occurs in the year of installation, the distribution of the depreciation will extend over eleven columns in the ledger, a similar half-year's charge being made in the eleventh column, or for 1922.

If no additional installations are made, if functional depreciation does not diminish the value more rapidly than physical depreciation, and if our estimate of the unit's lifetime has been correct, or nearly correct, no adjustments will be required except the annual deduction of the depreciation allowance from the balance brought forward from the previous year. In such a case the record of this unit, when it has become worn out, appears in Form 2.

Adjustments may be required, however, at times during the lifetime of the unit for either of two reasons: First, obsolescence or inadequacy[3] may so impair the functional value of

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[3] Provision is here made for obsolescence and inadequacy, although, as explained elsewhere, the author believes that they ought not to be considered as expenses. Since, however, it is still customary so to consider them, this chapter has not been altered from the general form which it took in the first edition of this book.

PLANT LEDGER

Sheet No. ____________

Unit Name or Number *Water wheel Governors.*

YEAR OF INSTALLATION OR ADJUSTMENT	ESTIMATE OF LIFE	ORIGINAL VALUE	ANNUAL DEPRECIATION BURDEN														
			1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
1912	10 years	$406.00	$20.30	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	20.30				
		Summary $406.00															
Scrapped 1922		406.00															
		0.00															
Balance brought forward			$406.00	385.70	345.10	304.50	263.90	223.30	182.70	142.10	101.50	60.90	20.30				
Deduct Depreciation {a physical			20.30	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	20.30				
{b functional			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Total			$20.30	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	40.60	20.30				
Depreciated Balance		$406.00	$385.70	345.10	304.50	263.90	223.30	182.70	142.10	101.50	60.90	20.30	0.00				
Add cost of Installation of year following			0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Balance forwarded		$406.00	$385.70	345.10	304.50	263.90	223.30	182.70	142.10	101.50	60.90	20.30	0.00				

Form 2. Plant Ledger Showing Distribution of Depreciation

the unit that its investment value drops below what the plant ledger indicates; secondly, with the passage of time, it may be found that the lifetime of the unit was incorrectly estimated, necessitating the distribution of its remaining value on a new basis.

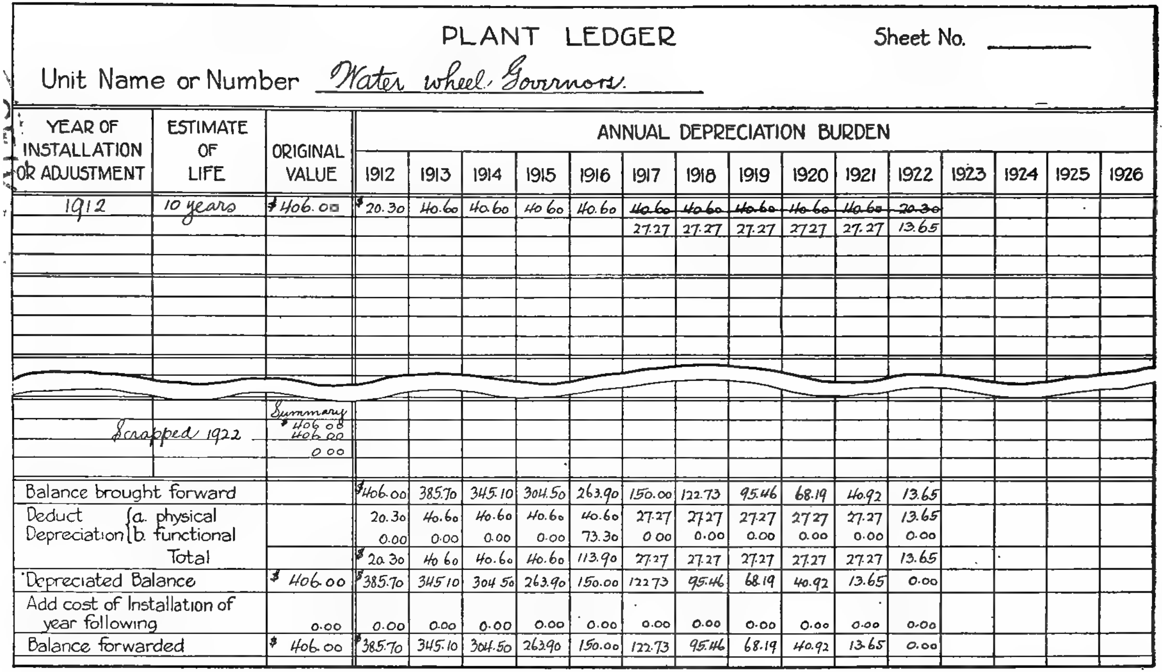
Adjustments for Obsolescence or Inadequacy

Let us assume that in the year 1916 certain causes lead to an abrupt fall in value, resulting from functional depreciation, the reduced value of the unit being found to be, according to principles stated on pages 21 to 34, $150. The balance brought forward for the year, as shown in Form 3, is $263.90, and the physical depreciation for the year is $40.60, leaving $223.30, or $73.30 excess over actual value. This amount must therefore be deducted as functional depreciation. Owing to this extraordinary deduction, it will be necessary to make a new distribution over the remaining years of the plant's life on the basis of the remaining value, $150. A red line should be drawn through the future distributions on the basis of old value and a new distribution made on the next line below. These alterations are shown in Form 3. No new entry is made in the column headed "Original Value," except in case of purchase of additional property.

Adjustments for Physical Depreciation

If, after a number of years, experience shows that the original estimate of lifetime was in error, a somewhat similar adjustment should be made; not, however, by altering the amount remaining to be depreciated, but by extending it over a greater or less number of years, thus decreasing or increasing the remaining annual charges. Such an adjustment is shown in Form 4 (see page 100) for the item which was installed in the year 1918.

The correctness of the work of a sheet may be checked by



PLANT LEDGER

Sheet No. ______

Unit Name or Number Water wheel Governors.

YEAR OF INSTALLATION OR ADJUSTMENT	ESTIMATE OF LIFE	ORIGINAL VALUE	ANNUAL DEPRECIATION BURDEN														
			1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926
1912	10 years	$406.00	$20.30	40.60	40.60	40.60	40.60	~~40.60~~	~~40.60~~	~~40.60~~	~~40.60~~	~~40.60~~	~~20.30~~				
								27.27	27.27	27.27	27.27	27.27	13.65				
Scrapped 1922		Summary $406.00 406.00 0.00															
Balance brought forward			$406.00	385.70	345.10	304.50	263.90	150.00	122.73	95.46	68.19	40.92	13.65				
Deduct Depreciation a. physical			20.30	40.60	40.60	40.60	40.60	27.27	27.27	27.27	27.27	27.27	13.65				
b. functional			0.00	0.00	0.00	0.00	73.30	0.00	0.00	0.00	0.00	0.00	0.00				
Total			$20.30	40.60	40.60	40.60	113.90	27.27	27.27	27.27	27.27	27.27	13.65				
Depreciated Balance		$406.00	$385.70	345.10	304.50	263.90	150.00	122.73	95.46	68.19	40.92	13.65	0.00				
Add cost of Installation of year following		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00				
Balance forwarded		$406.00	$385.70	345.10	304.50	263.90	150.00	122.73	95.46	68.19	40.92	13.65	0.00				

Form 3. Plant Ledger Showing Adjustment of Value

PLANT LEDGER

Sheet No.________

Unit Name or Number Water wheel Governors.

YEAR OF INSTALLATION OR ADJUSTMENT	ESTIMATE OF LIFE	ORIGINAL VALUE	ANNUAL DEPRECIATION BURDEN																
			1912	1913	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924	1925	1926	1927	1928
1912	10 years	$406.00	$20.38	40.60	40.60	40.60	40.60	~~40.60~~	~~40.60~~	~~40.60~~	~~40.60~~	~~40.60~~	~~20.30~~						
								27 27	27.27	27.27	27 27	27.27	13.65						
1918	10 years	200 00							10 00	20.00	20.20	20.00	20.00	~~20.00~~	~~20.00~~	~~20.00~~	~~20.00~~	~~20 00~~	~~10 00~~
														27 50	27 50	27 50	27 50		
		Summary 406 00 200 00																	
Scrapped 1922		606 00 406 00																	
Scrapped 1926		200 00 200 00																	
		0 00																	
Balance brought forward			$406.00	385.70	345 10	304 50	263 90	150.00	322 73	285.46	238.19	190.92	143.65	110.00	82.50	55 00	27 50		
Deduct Depreciation a. physical			20.30	40 60	40 60	40.60	40.60	27 27	37.27	47.27	47 27	47 27	33 65	27.50	27 50	27 50	27 50		
b. functional			0 00	0 00	0 00	0.00	73.30	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00		
Total			$20.30	40.60	40 60	40 60	113 90	27 27	37.27	47 27	47.27	47.27	33.65	27.50	27 50	27 50	27 50		
Depreciated Balance		$406 00	$385.70	345.10	304.50	263.90	150.00	122 73	285.46	238.19	190.92	143.65	110.00	82.50	55 00	27 50	0 00		
Add cost of Installation of year following		0 00	0.00	0.00	0.00	0 00	0 00	200.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	0 00	0.00		
Balance forwarded		$406.00	$385.70	345.10	304 50	263 90	150 00	322.73	285.46	238 19	190 92	143 65	110.00	82 50	55 00	27 50	0 00		

Form 4. Plant Ledger Showing Added Installation and Readjustment of Value

finding the total of the future distributions, which should be equal to the last depreciated balance.

In case of a sudden heavy fall in values due to functional depreciation, its deduction in the revenues of the current year would create an excessive burden. It might then be well to spread the extra charge over a period of, say, two or three years, by dividing it into as many equal parts. Thus in Form 3 the functional depreciation, amounting to $73.30, would be divided into three parts of $24.43 each and deducted over the three-year period 1916, 1917, and 1918, an equal amount each year.

In this somewhat extraordinary instance there would be a difference of twice $24.43, or $48.86—the amount not deducted in the current year—between the depreciated balance and the extensions in the depreciation columns; for while the latter are based entirely on the reduced value of the property, the former has not been reduced by the full amount. But as soon as the full amount of the functional depreciation has been deducted, the two will again be equal.

How Plant Ledger Is Controlled

As suggested, the plant ledger is controlled by the Plant account in the general ledger. Instead, however, of merely agreeing with its controlling account, as is usual with subordinate ledgers, the plant ledger should be in a twofold agreement with its controlling account; or perhaps it might be expressed by saying that it must agree with both the Plant account and the Depreciation Reserve account. For, whenever any accounts are charged in the plant ledger, the controlling Plant account is charged with an equal amount, the only difference being that the charges are subdivided in the plant ledger among the proper accounts; whereas their total is carried to the controlling account. Likewise, whenever any account is credited in detail in the plant ledger, which is done only when a unit of plant is scrapped, there will be an equal debit made to the Depreciation Reserve account in the general ledger. It follows that while the first cost of all existing units of plant is shown in detail in the plant ledger and in total in the Plant account in the general ledger, the actual depreciated value is indicated by the difference between the Plant account and the Reserve for Depreciation, shown best in the balance sheet by deducting the latter from the former, as explained in Chapter IV.

Reserve Indicates Composite Depreciation

If no renewals or replacements whatever were made to the plant, the continually increasing reserve for depreciation would indicate the growth of composite depreciation, which would finally consume the entire value of the plant. But as soon as they are needed, renewals are made, and after a time they entirely counterbalance the effects of depreciation, with the result that the reserve for depreciation indicates the extent to which at any time the composite depreciation of the entire plant has progressed.

Relation of Reserve to Replacements

The tendency of composite depreciation to reduce plant values below original investment values may be avoided by making additions to plant to the extent that composite depreciation is not covered by actual renewals, the additions being in reality replacement of values lost through depreciation. If the records are properly kept the extent of the composite depreciation of the original investment will be at all times indicated by the depreciation reserve, and this will in turn serve to indicate the amount which may be invested in additional plant when it is not needed in actual replacements. It must be remembered, however, that reserve for depreciation is not changed by such additions, being reduced only when old units are scrapped. The book value of the plant, i.e., the figure representing first cost, will therefore tend to increase over the figure indicating investment to an amount equal to the normal accumulated reserve for depreciation, which latter will continue to increase only so long as annual depreciation exceeds annual cost of replacement. After depreciation and actual replacement cost become equal, the plant is normal, and the depreciation reserve will tend to gravitate about a figure representing the ordinary amount to which depreciation may be allowed to progress without sufficiently impairing the plant's efficiency to make it more profitable to increase the replacements.

It may be unnecessary to add that the annual depreciation charge is found by totaling the sums deducted for depreciation for the year in the plant ledger.

The Depreciation Fund

If an actual depreciation fund is created, as suggested in Chapter IV, it would in itself indicate the amount of money to be expended on replacements in order to keep plant values up to 100 per cent of the original investment, and as a result would tend to disappear, remaining equal to the depreciation reserve only in case all replacements made are actual replacements of property scrapped, and have the same cost as the property so scrapped. The other valid use of the fund would be the amortization of a percentage of the capital, thus permanently reducing the investment.

Use of Property Ledger Advocated by United States Chamber of Commerce

The following quotation is taken from a pamphlet issued by the Fabricated Production Department of the Chamber of Commerce of the United States. It is given at length here because it will serve as material for comparison with what has been presented by the author.

It is not unusual to find assets grouped under such general captions as Buildings, Machinery and Equipment. The term "Buildings" may include wood, concrete, steel or brick structures designed for heavy use or light, may include fencing and wood bins, drainage systems and docks. The term "Machinery" may comprise electrical generators and steam engines, hydraulic presses and steam hammers, lathes, planers and boring and milling machines, woodworking machinery and small tools. The "Equipment" may vary from a locomotive train to pickling tanks, from glass furnaces to fire systems. The span of usefulness of these assets may vary from three years to thirty-three, yet all will bear a 3 per cent, 5 per cent or 10 per cent rate of depreciation, nor will it be possible to determine the depreciation record or history or the undepreciated value of any specific unit or type of property.

A classification of property is a prerequisite to the proper recording of depreciation.

Tax regulations, as well as ordinary accounting propriety, require that the allowance for depreciation should be computed and charged off with *express reference to specific items, units or groups of property,* each item or unit being considered separately or specifically included in a group with others to which the same factors apply.

Hence a proper record of depreciation requires that the specific items and units of property be enumerated and classified by kind, group or department, and that their original cost be ascertained, as well as the accumulated depreciation and the remaining useful life.

To do this will not be easy for an established concern accustomed to taking depreciation on a general grouping of property, such as Buildings or Machinery, and for such a concern "the splitting up and allocation of the old capital outlay must be approximate." Such allocation will, however, be greatly assisted by a competently made appraisal.

A complete record and history of depreciation as well as of plant and equipment can be secured through the property ledger, which aims to do for plant and equipment what the perpetual inventory record does for stock on hand.

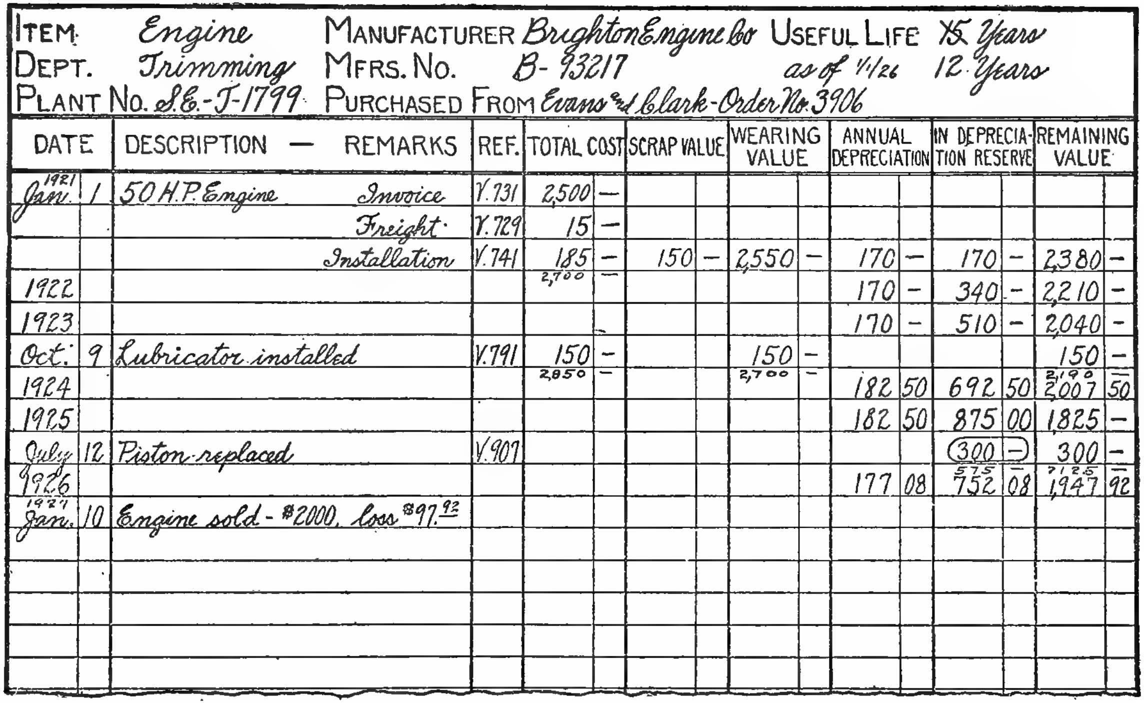
Such a property ledger will tie up with the general books of account, and will supply the detail for the total cost of property, the depreciation written off in any one year, the additions, renewals and disposition of property, the amount in the depreciation reserves, the estimated scrap value, and the net remaining sound value of property.

In addition, the property ledger will contain a brief description of all property, where located, plant identification, the name of manufacturer and manufacturer's number, from whom and when purchased, the total cost, including freight and installation charges, the estimated useful life of equipment and rate of depreciation, and it may likewise have a record of repairs, replacement values and a tabulation of monthly depreciation.

The property ledger can be conveniently compiled in card or loose leaf form, and each card or sheet ought to last from twenty to thirty years. Practically the same form can be used for departmental and final summaries of plant and depreciation. The complete financial, plant, and performance history of each item of property secured in this way guides future outlays upon plant, helps the accurate determination of loss or gain on specific assets, is of some importance in credit applications, simplifies the compiling and checking of tax and annual statements, and is invaluable in the event of a fire loss. The surprising thing is that there is still a comparatively large number of concerns operating without such a property ledger.

The arrangement of the form of property ledger as well as its size, etc., will depend on the ingenuity of the executive or cost accountant designing it, as well as upon his sense of what is important information for his particular requirements, industry or plant. It may be desired to compress all the information on a small card, using both sides, or it may be considered wise to keep track of monthly depreciation, the cost of repairs or replacement values. These are merely details to be adjusted to and by individual needs.

To illustrate [Form 5] the use of the property ledger, it is supposed that a 50 H. P. Steam Engine is purchased from Evans and Clark for use in the Trimming Department. S. E.-T. 1798 is its plant number, S. E.—symbol for Steam Engine, T. for Trimming Department. This plant number



ITEM Engine MANUFACTURER Brighton Engine Co USEFUL LIFE ~~15~~ Years
DEPT. Trimming MFRS. NO. B-93217 as of 1/1/26 12 Years
PLANT NO. S.E.-T-1799 PURCHASED FROM Evans and Clark-Order No. 3906

DATE		DESCRIPTION — REMARKS	REF.	TOTAL COST	SCRAP VALUE	WEARING VALUE	ANNUAL DEPRECIATION	IN DEPRECIATION RESERVE	REMAINING VALUE
1921 Jan.	1	50 H.P. Engine Invoice	V. 731	2,500 —					
		Freight	V. 729	15 —					
		Installation	V. 741	185 —	150 —	2,550 —	170 —	170 —	2,380 —
1922				2,700 —			170 —	340 —	2,210 —
1923							170 —	510 —	2,040 —
Oct.	9	Lubricator installed	V. 791	150 —		150 —			150 —
1924				2,850 —		2,700 —	182 50	692 50	2,190 — 2,007 50
1925							182 50	875 00	1,825 —
July	12	Piston replaced	V. 907					(300 —)	300 —
1926							177 08	575 — 752 08	2125 — 1,947 92
1927 Jan.	10	Engine sold - $2000. loss $97.92							

Form 5. Form of Plant Ledger Suggested by United States Chamber of Commerce. (Size 8½ x 11.)

appears on the name plate of machine where it can be easily seen. If the asset is frequently moved about the plant, it will be given a location number. The manufacturer is the Brighton Engine Co., the manufacturer's number B-93217. Its useful life has been determined at 15 years. The invoice for the engine comes to $2500, freight charges $15, installation $185, a total cost as of January 1, 1921, of $2700. The scrap value is computed at $150, leaving a wearing value of $2550, and an annual depreciation of $170, arrived at by dividing the wearing value by the useful life of 15 years.

The record of the engine is as follows:

1921. Normal depreciation of $170, no additions, no renewals. At the end of the year there will be $170 in the depreciation reserve and a net remaining value of $2380. (Wearing value $2550 less depreciation reserve $179.)

1922. Normal depreciation of $170, no additions, no renewals. At the end of the year there will be $340 in the depreciation reserve and a net remaining value of $2210.

1923. Normal depreciation of $170, no renewals, an addition in the way of a lubricator, installed Oct. 8, at a cost of $150. At the end of the year there will be $510 in the depreciation reserve and a remaining value of $2190. (The former wearing value of $2550 has been increased $150 to $2700, by the cost of the lubricator; $2700 less $510 in depreciation reserve, leaves a net wearing value of $2190.)

1924. The normal depreciation has been increased to $182.50. This is arrived at by dividing the new remaining value $2190 by the remaining useful life of 12 years. No additions, no renewals. There is accordingly at the end of the year $692.50 in the depreciation reserve, and a net remaining value of $2007.50.

1925. Normal depreciation of $182.50. Other things being equal, there would accordingly be $875 in the depreciation reserve at the end of the year, and a net remaining value of $1825, but on July 12 the old piston has been replaced by a new one costing $300. This $300 is charged against the accumulated depreciation, reducing that to $575, and increasing the remaining value by just that much to $2125.

1926. At January 1, 1926, the asset has been in use five years. Its remaining useful life accordingly would be ten years, but the replaced piston, etc., it is assumed, prolongs the useful life two years, and the remaining useful life of the asset is correspondingly changed to twelve. This remaining useful life, twelve years, divided into the remaining value, $2125, gives a new annual depreciation charge of $177.08. At the close of the year, the depreciation in reserve will amount to $752.08 and the remaining value $1947.92.

1927. On the tenth of January the machine sold for $2000. On the proper page of the journal an entry corresponding to the following will appear:

Cash	$2,000	
Reserve for Depreciation	752.08	
Profit and Loss	97.92	
Buildings		$2,850

The sales price, $2000, plus the accumulated depreciation, $752.08, $2752.08, deducted from the total cost $2850 indicates a loss of $97.92 on the transaction.

A notation can be written in red ink across the face of the property ledger page, or the items of cost, scrap and wearing value, depreciation reserve and remaining value closed out. At all events, the page will be taken out and filed in the rear of the ledger.

This hypothetical history is given to show how the property ledger operates and by what manner of contingencies it is affected.

CHAPTER VI

DEPRECIATION AS MANUFACTURING COST

The Elements of Cost

The tendency has been noticeable, for a long time, to substitute machinery for labor in manufacturing, and, furthermore, to substitute more expensive for less expensive machinery and buildings. In some instances whole processes once performed by hand, with the aid of simple and inexpensive tools, are now executed almost exclusively by mechanical means. The change has resulted because these new methods of manufacture are cheaper, or at any rate are thought to be cheaper, than the methods which they have supplanted.

As a result the proportionate amounts of the elements entering into the cost of given manufactured products have been radically altered. The labor element has been reduced, while the overhead or burden element, of which depreciation is an important factor, has been increased, if not sufficiently to offset the decreased labor cost, at least very considerably. Under these circumstances it becomes increasingly important to determine what has been well termed the "incidence of depreciation on the cost of the product." [1]

It is unnecessary here to enter into a detailed analysis of all of the elements which comprise the total cost of a manufactured product. Briefly, these elements may be outlined as follows:

1. Raw materials
2. Expense of manufacture
    - (a) Direct labor
    - (b) Overhead or burden

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[1] Garcke, E., and Fells, J. M., *Factory Accounts* (1911), p. 128.

We are here concerned with overhead or burden and the manner of allocating this to manufactured product.

Formerly the elements which together comprise prime cost —labor and direct material—were regarded as the only elements of cost. The gross profit was the difference between the sum of these and the selling price. This was carried to the credit side of the profit and loss account, while the items now going to make up indirect cost, if they were taken into account at all, were entered as charges on the debit side of profit and loss. Now, of course, they are regarded as proper charges to the manufacturing section of the income account. It is now recognized that the cost of using plant and machinery is a very considerable part of the total cost of production, in fact is frequently the chief element in determining whether machinery or hand power is cheaper. They are equally important in showing the relative cheapness of different types of machines and structures.

In so far as the general principles which govern depreciation are concerned the problem of cost accounting gives rise to no new questions; but it does give rise to the additional task of allocating depreciation cost to output. Overhead or burden is composed of three elements: indirect material, indirect labor, and indirect expense. This problem of overhead is the most complicated one with which cost accountants must deal, and it is the failure to solve it which causes so many so-called cost systems to fail. J. Lee Nicholson lists the following indirect expenses:[2]

Rent
Insurance—fire and liability
Taxes
Interest
Depreciation
Maintenance, repairs, and renewals

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[2] Nicholson, J. L., and Rohrbach, J. F. D., *Cost Accounting* (1919), p. 17.

Power
Light
Heat
Freight and cartage inward, when not considered as a part of the direct material charges
Over, short and damage
Miscellaneous factory expenses

Depreciation and Working Capital

Since depreciation does not require immediate financing, its recovery through sales during a period when financial difficulties require that renewals and replacements be kept down to a minimum means an addition to the working capital of the organization. On the other hand, if the manufacturer omits depreciation costs he merely delays recovering the loss until some later period. Only extraordinary or unusual circumstances can justify such a policy of delay, and whenever possible current depreciation costs should be fully covered in the selling price. In this connection we may note the statements of William C. Redfield in his book, *The New Industrial Day:*[3]

> Depreciation is a large item of cost, amounting often to as much as ten per cent per annum of the entire value of the machinery, buildings, and other equipment, varying with conditions. Sometimes neglected by manufacturers, it forms a burden of a self-enforcing character which, if not reckoned as an annual addition to burden cost, will come in a lump sum whenever machinery or buildings must be replaced.

Article V of the Standard Cost-Plus Contract, under which much of the materials purchased by our government during the war was manufactured, provided:

> A fair amount to cover the depreciation accruing during the period of production of the articles under this contract on that portion of the plant, equipment and facilities owned by the Contractor and used in or necessarily rendered idle

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[3] P. 107.

> on account of the production of the articles herein contracted for and properly chargeable thereto.

This recognizes the validity of including depreciation among current manufacturing costs.

Not All Depreciation Is Manufacturing Cost

Only depreciation which is contributory to or rendered necessary by the manufacturing process should be considered manufacturing cost. Depreciation cost incurred in connection with the administrative function is administrative expense, as that which is incurred in connection with selling is a trading expense. Proper systematization of plant will render it possible to make an accurate alignment of plant and equipment so that the functions of different groups can be easily ascertained and depreciation accordingly be charged to the proper class of expense.

Allocation of Overhead

The method of allocating overhead, in general, depends upon the character of the cost system in operation. A cost system must fulfil certain requirements. It must provide means for determining and reporting all elements which enter into cost of output, i.e., all labor, material, and overhead costs. Facilities must also be provided for the accurate compilation of these elements and their application to the right job or order in process of manufacture. The arrangements made to accomplish these ends necessarily vary with the nature of the industry and the general scheme of cost-keeping in force.

For the purpose of ascertaining costs, either the order method or the process method should be employed, depending upon the nature of the industry. In general, the order method is suitable to those industries in which the work is segregated on definite units of output which pass as units or readily definable groups through the various manufacturing processes.

Among industries which find this method applicable are garment manufacturers, wood-working plants, and shops engaged on repair work. In some cases there is, however, a large and continuous process in which it is impossible to make any distinction, such as is made when the order method is used. One part of output is quite indistinguishable from another of the same kind, so that there is no distinction between groups until division is finally made for selling purposes. When these conditions exist the process method of finding costs is used.

DEPARTMENTAL BASIS OF ALLOCATING OVERHEAD.—All well-organized factories are divided into departments whose functions are determined by an analytical study of the manufacturing process. In fact a classification of departments must be made before it is possible to determine the kind of cost system which is best adapted to a given establishment. The department, furthermore, serves as the basis for the allocation of overhead expense or burden. In so far as possible all elements of overhead—indirect material, indirect labor, and indirect expense—must be compiled on a departmental basis. But there are elements of indirect expense which cannot be charged directly to departments.

In general, departments are either productive or non-productive. Productive departments are those which work directly on the product being manufactured. Non-productive departments are those which aid the productive process indirectly by supplying to the productive departments the various things and services which they require for their work. Illustrations are: the employment department, which secures necessary recruits to the labor force, and the power department, which supplies power to operate machinery. Sometimes, of course, departments may be found which perform both productive and non-productive functions.

The costs of operating productive departments and those indirect expenses which cannot be charged directly to a given department because they are not incurred for any one department—such, for example, as the salary of the general manager, taxes, and so on—are treated similarly. They must be spread over or allocated to the various productive departments on some equitable basis. The following are possible bases of distribution of indirect expenses which cannot be charged directly to departments:[4]

Account	Basis of Distribution
Insurance—Building	Floor space
Insurance—Merchandise	Value of property
Repairs on Building	Floor space
Depreciation of Building	Floor space
Taxes on Building	Floor space
Light	Candle-power required
Heat	Cubic feet of space
Salaries of General Officers	Net sales
General Administrative Expense	Net sales
Bad Debts	Net sales

In so far as possible overhead should be charged directly to departments, since such procedure makes it unnecessary to allocate it on some such formal basis as that suggested above. Thus where any item of indirect material, indirect expense, or indirect labor is incurred for a certain department and not for general factory purposes, it should be charged directly to the overhead account of that department, not to general factory overhead. Supplies can frequently be charged to departments, also small tools. Much indirect labor expense can also be charged direct, such as that of departmental foremen, helpers, and truckers. Some forms of expense, such as electric lighting where departmental meters are kept, can also be so charged.

Allocating Depreciation to Departments

Depreciation charges must be allocated to departments either directly or indirectly. The extent to which they can be allocated directly depends upon the extent to which equipment is itemized for depreciation purposes. If the depreciation charge for the entire plant is calculated on the total valuation of plant and equipment, it is evident that the depreciation burden for the departments must be secured by a method of allocating similar to that employed for allocating other general factory costs to departments. It follows that it is desirable, in so far as possible, to segregate machinery and equipment by departments as the first step towards a scientific method of calculating depreciation costs and allocating them as charges to the products of the various departments.

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[4] Saliers, E. A., *Accounts in Theory and Practice: Principles,* p. 248.

As a consequence, as much of depreciation cost as possible should be made a direct departmental expense, while that which cannot be ascribed directly to given departments remains a part of general factory overhead to be allocated to departments on some more or less arbitrary basis. Nicholson asserts that depreciation charges should be applied to departments upon the basis of the total valuation of the equipment in each;[5] but apparently he does not distinguish carefully between property which is strictly departmental, for which a direct depreciation charge can be made, and property which is intended to promote the welfare of the plant as a whole, the depreciation costs of which must be carried indirectly to departments on some such basis as that suggested on page 113 above.

In determining the incidence of depreciation to departments, the non-productive departments should be charged with their proper share of depreciation, both that which is specially applicable to their peculiar equipment and that which represents their due share of general depreciation. It ultimately finds its way into the cost of manufactured product when the cost of operating non-productive departments is allocated to productive departments on an equitable basis.

After all general factory expenses are allocated to the proper departments and after the costs of operating non-productive departments have in turn been distributed on some reasonable basis to productive departments, it is possible to ascertain total overhead for each productive department. This consists of two parts, namely: (1) direct departmental overhead, and (2) indirect departmental overhead, which latter in turn consists of: (a) general factory overhead secured when general operating expenses were allocated to all departments, productive and non-productive, and (b) costs of operating non-productive departments allocated to productive departments after general operating expenses have been distributed to all departments as in (a) above.

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[5] Nicholson, J. L., and Rohrbach, J. F. D., *Cost Accounting* (1919), p. 144.

The total overhead thus ascertained for the productive departments is the sum which must in turn be charged to the products being manufactured in the departments during the period in question.

Overtime, Idle Time, and Depreciation Rate

Since all manufacturers experience the vicissitudes which result from changing financial conditions, it is necessary to take into consideration the effects of overtime and idle time on the cost of manufacture by giving expression in the accounts to their effect on the depreciation rate. It is quite clear that overtime must cause some increase in the rate of depreciation; it also seems reasonable to assume that, under some conditions, idle time tends to decrease the rate of depreciation of some or all of the equipment. The war made it necessary for some plants to increase both the length of the working day and the speed of production, while it compelled some non-essential industries to reduce production. To enable manufacturers who worked on government cost-plus contracts to arrive at tolerably accurate costs as well as for income tax purposes, it became necessary to study the effects of overtime on depreciation rates.

PRACTICE OF BUREAU OF AIRCRAFT PRODUCTION.—The Rulings Board of the Finance Division of the Bureau of Aircraft Production prescribed the following yearly rates of depreciation as the basis for monthly payments on a cost-plus basis to contractors operating two or more shifts per day:

	1 Shift %	2 Shifts %	3 Shifts %
Main buildings, brick and concrete	2½	3	4
Substantial wooden buildings	5	6	7
Factory equipment	10	12½	15
Electric equipment	12½	15	18
Heating and melting furnaces	6	8	9
Machinery	7½	10	12
Furniture and fixtures	10	12½	15

The rates given in the first column are for an 8-hour day, while the rates prescribed for overtime presumably were arrived at after giving consideration to the abnormal conditions under which war plants were operating. Overtime affords less opportunity than usual for ordinary repair and replacement. Moreover, when there are two or three shifts per day machines operate under the supervision of different individuals each of whom tends to leave minor matters of adjustment to his successor. Night work is harder on machines than is day work. The taking on of new increments to the labor force tends to dilute the average efficiency of labor. It has been shown, moreover, that a constantly driven machine tends to give out as the result of what is sometimes termed "mechanical fatigue."

PRACTICE OF A LARGE STEEL COMPANY.—The following table, taken from Nicholson and Rohrbach's *Cost Accounting,*[6] expresses the view of the auditor of a large American steel company. It is based on a normal day of eight hours.

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[6] 1919 edition, p. 157.

8	hours—normal depreciation					
9	"	5%	of	normal	depreciation,	additional
10	"	10%	"	"	"	"
11	"	15%	"	"	"	"
12	"	20%	"	"	"	"
13	"	25%	"	"	"	"
14	"	30%	"	"	"	"
15	"	40%	"	"	"	"
16	"	50%	"	"	"	"
17	"	60%	"	"	"	"
18	"	70%	"	"	"	"
19	"	80%	"	"	"	"
20	"	90%	"	"	"	"
21	"	100%	"	"	"	"
22	"	115%	"	"	"	"
23	"	130%	"	"	"	"
24	"	150%	"	"	"	"

The following qualifying remarks are made by the advocate of the above rates:

> We feel that in fairness to all, after a normal rate of depreciation has been established, the allowance for overtime depreciation should exclude the element of obsolescence. This would mean that the allowance for overtime depreciation *up to a certain point* would not increase in the same ratio as the number of hours. In other words, we consider that the factor of obsolescence would be constant, and the only varying element would be the actual depreciation due to wear and tear. The "certain point" referred to above should be sixteen hours. After this point, we consider depreciation takes place very rapidly and we feel that in the above table the conditions are truly presented.
>
> We think, furthermore, that it would be an injustice not to consider that the auxiliary departments of a plant should be subject to overtime depreciation. By this is meant such departments as steam, power, water, transportation, etc. Obviously, a "speed-up" program is felt in every department in the plant. It is conceded that these departments do ordinarily work 24 hours a day, but it is only in a measure. Under normal conditions they are working at full capacity

> only a fractional part of a day, and it was on this basis that normal depreciation was figured. If, however, it is required that these plants be run at full capacity for a greater than their normal time, it cannot be denied that there is additional depreciation.
>
> We feel that the application of overtime depreciation will necessitate the determination of normal depreciation for each department in the plant. Furthermore, the determination of the number of hours a department is working overtime, unless treated in a broad way, might resolve itself into a complicated problem. Not knowing the attitude that will be taken in this respect, we hesitate in offering any suggestions.

OTHER AUTHORITIES.—Other authorities who have given careful consideration to this matter are of the opinion, however, that in no case should the rate of depreciation for overtime operations exceed twice the normal rate, i.e., an additional 100 per cent. J. P. Parlin states that, "the only variable in overtime use or diluted labor is wear and tear." He suggests that every manufacturer should have a machine reserve supply to prevent unnecessary destruction, that proper supervision by those entrusted with repair and maintenance of machinery will result in proper upkeep irrespective of shifts, that where machines operated by night shifts are repaired by day crews there is shown no appreciable effect of the lessened efficiency of the night shifts, and that even though the efficiency of labor is reduced by taking on less skilled men the effect is absorbed in maintenance charges which are additional to depreciation, and that age deterioration and obsolescence are not affected by overtime. Consequently the only factor affected by overtime is wear and tear, and this effect is partially offset by maintenance. He therefore concludes that "the total allowance for overtime or other causes should not exceed 100 per cent additional of the normal rate." [7]

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[7] Quoted in Nicholson and Rohrbach's *Cost Accounting* (1919), p. 159.

Nicholson also believes that 100 per cent additional to the normal rate should be the extreme allowance and suggests:

11	hours—	add	5%	of	the	normal	rate
12	"	"	10%	"	"	"	"
13	"	"	15%	"	"	"	"
14	"	"	20%	"	"	"	"
15	"	"	25%	"	"	"	"
16	"	"	30%	"	"	"	"
17	"	"	35%	"	"	"	"
18	"	"	40%	"	"	"	"
19	"	"	45%	"	"	"	"
20	"	"	50%	"	"	"	"
21	"	"	57½%	"	"	"	"
22	"	"	67½%	"	"	"	"
23	"	"	80%	"	"	"	"
24	"	"	95%	"	"	"	"

The Committee on Appeals and Review of the Bureau of Internal Revenue has recommended "that depreciation rates be determined by the life of the property and applied to value determined at acquisition, with an accelerated rate on machinery during 1917 when the plant was running at double capacity."[9]

Reducing Depreciation Costs

Anything which can be done to prolong the operating life of physical assets reduces the depreciation cost per unit of output. It does not, however, diminish the likelihood of the intervention of obsolescence. Nevertheless, whatever can be done to lengthen the useful life of wasting assets is a step towards economy. There are various ways in which this can be done, and the character of the assets in question will determine to a large extent what these must be. The life of certain kinds of equipment can be extended almost indefinitely and there is a possibility that such assets may be continued in use long after they have become obsolete. This would be economy carried to extremes.

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[8] Pp. 159-60.

[9] *Committee on Appeals and Review Memorandum*, p. 390.

One way of prolonging the useful life of machinery and equipment is to select that kind which is best adapted to the work to be done. Thus if delivery wagons are too light they will not stand up as well as wagons which are better adapted to the particular class of work in hand. If a concern requires a fleet of, say, 100 delivery wagons, then it will be found profitable to keep a reserve of possibly 10 wagons, so that those which need repairs can be withdrawn from service at once and be replaced by cars held in reserve. Standardization and interchangeability of parts facilitate repairs and reduce their cost. The policy followed in regard to upkeep and repairs must be taken into consideration when the general depreciation policy is being determined.

Depletion as Manufacturing Cost

In some cases manufacturers own the mines which supply them with the required ores used in the manufacturing process. This ore is a cost of production as much as if it were purchased from another company. It is necessary, therefore, to give it its proper value in order that it may be incorporated in the cost of the manufactured product. The revenue law of 1918 provides that the value as of March 1, 1913, or within thirty days after discovery, shall be the basis of reckoning depletion for income tax purposes, and in so far as possible the same basis should be employed for purposes of ascertaining manufacturing costs. The following quotation from a memorandum submitted to the Federal Trade Commission by a large steel manufacturing corporation relative to the establishment of fair prices for steel products is of interest:

> In the consideration of the cost of steel the question of the value of property consumed arises first in connection with ore, and other minerals which constitute the raw materials of production. Logically the fair value of ore in the ground at the moment when production commenced is clearly

> capital and the producer should receive its capital value at that time as a part of cost, otherwise he would be deprived of some part of his capital without compensation. This principle is clearly recognized in the present income tax law which provides that the capital value at March 1, 1913 (the date when the first income tax law became effective) of ore consumed in production shall be a deduction from gross income in arriving at net income. The same rule is applicable and is applied by the income tax law to all realizations of tangible capital assets such as lands, buildings, plant, etc. Strict application of this principle would require therefore that in determining cost today depletion and depreciation should be computed on present day values, say those of January 1, 1917. It may, however, be claimed that those values were abnormal and due to the opportunities of employing such assets to earn war profits which it is now proposed to restrict, and that to accept the logical rule would therefore result in giving the producer a large war profit in the form of cost. On the other hand, it is clearly unfair to compute cost upon the basis of the cost of the capital assets to the producer without regard to the date of their acquisition by him. To do so would result in allowing one producer two or three (perhaps five to ten) times as much per unit as another would receive for a precisely similar unit.

Although this refers in particular to war conditions the principles involved are of general applicability. In general the values which should serve as the basis for the determination of costs should be the same as those which govern the other aspects of the problem.

Allocation of Depreciation Cost

Since all depreciation which is incurred directly or indirectly in the furtherance of manufacturing processes is a manufacturing cost it is necessary to contrive means of allocating it to jobs. The plant ledger,[10] which is a complete record of plant, should be so arranged that its various subdivisions will correspond with departments in so far as each unit of the plant can be definitely considered as being useful only in a given department. One or more divisions of the plant ledger should be used to record those items of plant the depreciation cost of which cannot be considered as departmental in character and which must therefore be allocated to departments on some fairly accurate though arbitrary basis.

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[10] See Chapter V.

When the plant ledger is thus organized on the basis of departments, it is a relatively easy matter to determine the total amount of depreciation cost directly allocable to departments as well as that which is general in character and to be allocated arbitrarily to departments. Having found the total annual depreciation cost per annum for a given department by adding to such departmental cost the proportion of general depreciation cost applicable to such department, the total monthly depreciation cost for the department is found by dividing by twelve.[11]

This amount must be distributed over the orders which have been worked upon in the department during the month in question. The manner of doing this will depend upon the method of burden distribution employed.

If the new machine rate method is employed the depreciation cost for the department is allocated to the machines being operated in the department along with the other costs exclusive of direct labor and material,[12] and a machine hour rate is secured which reflects the total cost of operating a given machine an hour. This rate is determined on the basis of normal operations. If all machines in a given department are not kept in operation during the full normal number of working hours in the month there results a certain amount of overhead which is not carried to the cost of the product through the application of the normal machine rate. This may either be distributed as a manufacturing cost to the proper orders by means of a supplementary rate or it may be carried direct to profit and loss, according to the theory followed.

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[11] This assumes an even distribution throughout the year. In general this is correct since depreciation is to a large extent a fixed charge. Adjustments may be necessary, however, in case of seasonal activity and idleness, and overtime.

[12] The reader is referred to the writings of Gantt, Scovill, Church, and others for a detailed discussion of this subject. A brief discussion of the general subject of costs and the allocation of indirect may be found in the author's *Accounts in Theory and Practice: Principles*, pp. 251-68.

If the prime cost method of allocating indirect is followed, the basis of distributing indirect is the combined material and direct labor cost, that is, the indirect allocable to a given order number is proportionate to the material and direct labor cost.

Repairs versus Depreciation

As has been shown elsewhere the distinction between repairs, which ordinarily are a direct current charge to income, and renewals, which ordinarily are charged directly against the depreciation reserve, is one which is of first-rate importance. Repairs are a manufacturing cost in the same sense as is depreciation, the only difference lying in the methods employed to allocate them to the articles being manufactured. Repairs, like depreciation, may be either a departmental or a general overhead expense. Whenever possible repairs should be charged direct to the department which benefits therefrom. When this is impossible the allocation to departments must be made on some arbitrary basis such as is elsewhere discussed. This distinction between repairs and depreciation is to be noted, however—that whereas depreciation should be scientifically calculated on the basis of cost less salvage with the estimated life of the asset as a divisor, no such computation is required for repairs, which ordinarily should be regarded as an expense current in the period in which incurred. There may be exceptions to this rule, as when an excessive amount has been expended in a given period and it is found desirable to spread it over one or more succeeding periods as a deferred charge. The character and extent of plant are factors which will greatly affect these considerations.

Expenditures which ultimately are charged as depreciation costs are first capitalized; later this is written off, income being charged and a reserve credited. Repairs are charged direct against revenues through the proper section of the income account. If they are a manufacturing cost they will appear in the manufacturing section, and they will be charged to the proper order number in the subordinate manufacturing or cost ledger after being treated either as direct departmental or as general overhead.

An Illustration

Assume that a factory consists of four departments, A, B, C, and D. The general plant depreciation applicable to the manufacturing process is $2,000 monthly. In addition the depreciation costs which can be determined on a departmental basis are as follows per month:

Department A	$500
Department B	800
Department C	350
Department D	600

These figures are found by proper computations based on data presented in the plant ledger.

It is necessary to fix upon some plan of allocating general factory depreciation to departments. If, as suggested above, the allocation is to be made on the basis of floor space, we may assume that the floor space for the departments is found to be as follows:

	Sq. ft.
Department A	20,000
Department B	40,000
Department C	15,000
Department D	25,000
	100,000

The amounts chargeable to the departments are as follows:

Department A, 20% of $2,000, or........	$ 400
Department B, 40% of 2,000, or........	800
Department C, 15% of 2,000, or........	300
Department D, 25% of 2,000, or........	500
	$2,000

The total depreciation cost per month for each department is, therefore, as follows:

	Departmental		General	Total
Department A	$ 500	plus	$ 400	$ 900
Department B	800	"	800	1,600
Department C	350	"	300	650
Department D	600	"	500	1,100
	$2,250		$2,000	$4,250

Each manufacturing department is thus charged with its total depreciation burden and must make the proper distribution to its orders in process during the given month. In the financial records this depreciation expense represents a charge to Manufacturing and a credit to the Depreciation Reserve account, as follows:

Manufacturing	$4,250	
To Reserve for Depreciation		$4,250
To represent the month's depreciation cost chargeable to goods manufactured as one of the costs of manufacture.		

The Manufacturing account controls the cost ledger, so that the same amount is distributed over the order numbers whose records are shown in the cost ledger. It may be, of course, that the depreciation cost will not appear as a separate item on the cost sheets because it may be merged with other items of indirect cost, the total being shown in the form of a machine rate, or as a percentage of prime cost.

The manner in which each department makes the distribution of its quota of depreciation expense to jobs or order numbers depends upon the method of allocation of burden or overhead employed. If the machine rate method is in use the depreciation expense is combined with other indirect applicable to the department and the total indirect is allocated to machines or production centers and serves as the basis for the determination of a machine hour rate which will be sufficient to exhaust the total month's overhead applicable to such machine or production center in a month's time.[13] The following quotation from the author's *Accounts in Theory and Practice: Principles* [14] will serve to explain the principles involved:

> To illustrate, assume that the total number of machine hours for a given machine, running full time, is 360 for a given month, and that the total indirect applicable to that machine is estimated to be $720 for that month. Its rate per hour is, therefore, 720 ÷ 360 or $2. But if idle time for the month for this machine amounts to 60 hours, the unapplied portion of the estimated burden will amount to 2 × 60 or $120. Further, let us assume that in due time the actual indirect for this month is ascertained to be $780, or $60 in excess of the estimated indirect. To simplify matters for illustrative purposes assume further that the machine's time during the month has been occupied exclusively upon four order numbers. Below is shown the appearance of the account for indirect and also the cost ledger accounts for the four orders, after the indirect has been distributed, first by the direct rate, secondly, by the first supplementary rate, and, thirdly, by the second supplementary rate:

GENERAL LEDGER

INDIRECT, DEPT. A

Actual Indirect	$780	Direct rate	$600
		1st Supplementary	120
		2nd Supplementary	60
	$780		$780

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[13] It is necessary, of course, to base current charges on the preceding month's overhead costs. After the month's overhead costs are compiled it may be desirable to make an adjustment in the form of a supplementary rate, or otherwise.

[14] Pp. 262-63.

Cost Ledger

Order No. 230 (70 hrs.)

Direct Rate	$140
1st Supplementary	28
2nd Supplementary	14

Order No. 231 (100 hrs.)

Direct Rate	$200
1st Supplementary	40
2nd Supplementary	20

Order No. 232 (70 hrs.)

Direct Rate	$140
1st Supplementary	28
2nd Supplementary	14

Order No. 233 (60 hrs.)

Direct Rate	$120
1st Supplementary	24
2nd Supplementary	12

The hours indicated within the parentheses are the actual number of hours spent by the machine on the different orders. The "direct rate" charge is made on the supposition that the machine operates full time. The "1st supplementary" charge distributes the balance of estimated indirect resulting from idle time. The "2nd supplementary" charge distributes the excess of the actual over the estimated indirect. The "1st supplementary" rate is secured by dividing the unapplied burden resulting from idle time, $120, by the number of operating machine hours for the month, 300, which gives, as the first supplementary rate per hour, $0.40. The "2nd supplementary" rate is secured by dividing the excess of the actual indirect over the estimated indirect, $60, by the number of operating machine hours for the month, 300, which gives as the second supplementary rate per hour, $0.20. The various distributions are shown in the above accounts.

The amounts credited to the accounts for departmental indirect, in the general ledger, are in turn charged to the Manufacturing account, which may also be a departmental account in the general ledger.

CHAPTER VII

METHODS OF DEPRECIATION

Depreciation as Affected by the Point of View

The purpose of this chapter is to describe the various plans that have been and still are advocated as valuable aids in the determination of the depreciation charge.[1] Only after having secured an understanding of the principles employed in any method can its real significance be realized, and only thus can we place ourselves in a position to pass a rational criticism upon the different methods. For this reason more space has been given to their consideration than might otherwise have been necessary. The whole question of method has become so confused in the contest between conflicting views and opinions that it merits the most careful consideration.

Oftentimes obscurity results from inability to keep definitely in mind the full significance of the thing for which we are striving. The question of depreciation is chiefly concerned with two things:

1. The determination of the *cost* of maintaining the investment, which in turn is dependent upon—
2. The extent to which the investment has depreciated as the result of wear and tear, or other physical decay, or of obsolescence or inadequacy.

The cost of maintaining the investment may in turn be regarded as one of the elements entering into the cost of the output, either service or commodity, along with labor, fuel, and so on.

In valuations the question of depreciation is not essentially different, the difference being one rather of viewpoint than one which affects the fundamental problem itself. In valuations attention is directed rather to the extent of the depreciation at a point in time, for the purpose of determining value *at that time,* while from the other standpoint, depreciation *over a period* is the more important consideration. Valuations are made, for instance, to determine whether the owners of the property are securing an adequate return on their property at the time of valuation. This is the point of view of the public service commission, which touches upon a corporation's affairs only at intervals, and somewhat as an external, supervisory agent. From the viewpoint of the company officials, on the other hand, depreciation is a constantly accruing expense, to be as constantly refunded out of the revenues of the business.

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[1] See Appendix D.

Cause and Effect

When the character and extent of an occurrence is determined by the operation of one or more agencies or forces, it is said to be functioned, or dependent, upon such agencies or forces. As the temperature falls, a steel rail contracts slightly; therefore its length, within certain limits, is functioned upon the temperature. Similarly, the accumulations of a sinking fund are functioned upon: (1) the amount of the contributions to the fund, (2) the rate of interest, (3) the time during which the sinking fund accumulates, (4) the frequency with which interest is compounded. Likewise, the extent to which an investment in an industrial plant depreciates is functioned upon: (1) the wear and tear, (2) obsolescence, arising from the possibility of displacement, (3) inadequacy to perform its work, etc. Depreciation is not functioned upon passage of time but is merely conveniently measured in terms of time. Thus we say that in 5 years a plant depreciates 20 per cent of its cost price. We use periods of time as a convenient way of comparing the rapidity of depreciation with the rapidity with which other occurrences coming within our experience take place. Without the action of such agents as wear and tear, obsolescence, or inadequacy, the investment would not depreciate at all.

Great Accuracy Impossible

The effects of past wear and tear, obsolescence, and inadequacy can be ascertained within reasonably narrow limits. The future effects of wear and tear, although they cannot be anticipated with entire certainty, may also be estimated, from experience, with a reasonable degree of certainty. Oftentimes even inadequacy may be foreseen, though usually with a smaller degree of certainty than wear and tear, because it is sometimes functioned upon unforeseen changes, such as movements of population, changes in demand, etc. Obsolescence can be predicted with perhaps even less certainty. It is worth noting, however, that although individual occurrences of a given character transpire apparently with entire uncertainty as to time, when large numbers of such occurrences are studied they may be found to follow a law. Thus the length of an individual life is altogether uncertain. Yet when considered in large numbers it is discovered that the span of the average life is calculable with enough accuracy to serve as a basis for the science of life insurance.

Much of the same thing is true of the items that compose an industrial plant, although it might not be profitable to carry the analogy too far. Mortality tables of structures have been used, and still greater accuracy may be expected as the result of longer experience. It will therefore be possible to gauge physical decay with reasonable accuracy, while obsolescence and inadequacy may be covered by a reasonable allowance made from surplus. This reservation of surplus offsets any bad effects resulting from accruing but ineffective obsolescence and makes it possible to care for depreciation from wear and tear separately, and thus to secure greater accuracy.

The Straight-Line Method

The simplicity of the straight-line method of determining depreciation stamps it with the appearance of practicability. It is free from interest complications, and its employment does not require a knowledge of the logarithmic or any other method of finding roots and powers of numbers. Speaking generally, there appears to be no reason why the straight-line method does not approximate actual depreciation as nearly as any of the complicated curves at times advocated, apparently on the assumption that actual depreciation finds a counterpart in the accuracy of their mathematical computations.

It is not meant, however, to recommend unconditionally the straight-line method. The question is one of expediency rather than accuracy; of expediency based on the principle that the interest of stockholders, bondholders, and the public must be diligently protected. To do this the procedure adopted should guarantee the return to the business through the rates charged, of an amount *approximately* equal to the expiration of plant values incident to the production of the commodity or service sold. It is axiomatic that depreciation from wear and tear is one of the costs of production, and hence a corresponding amount should be charged to gross income, and thus be retained to offset the exhaustion of capital.

The Reducing Balance Method

This method possesses the advantage of freedom from interest calculations, but, like any other method based on a fixed procedure, does not take into account either the actual rapidity with which depreciation occurs, or the various modifying factors which may show their influence at any time. Since this objection is common to all methods, other considerations will probably lead to a choice. Emergencies can in no case be foreseen; and the best that can be done is to alter the basis upon which future depreciation allowances are computed, changing the figures indicating value and remaining lifetime to conform to the altered conditions.

A glance at the table and Form 7 on pages 148 and 149 shows what a preponderance the reductions for the first few years, for a property having a lifetime of 25 years, bear to those of later years. Such a rate of reduction must usually be out of all proportion to the actual rate of depreciation of the units of which an industrial plant is composed. From one point of view this is the method of extreme conservatism, since it writes down plant values far more rapidly than any other, and removes almost any possibility of a failure to set up adequate reserves. Usually the net result will be the formation of a secret reserve through the undervaluation of assets. Even if we assume the desirability of such a procedure, it may be questioned whether a new plant could bear the burden of the resulting heavy charges to revenue.

In an old plant the effects of the application of this method to many units of property of various values, lifetimes, and conditions, will tend to give a result of greater uniformity in proportion to the extent and variety of the plant; tending, however, to create a secret reserve measured by the excess of the actual value over the book value of the assets. It might be used to advantage in certain instances where obsolescence or inadequacy rapidly encroaches upon the property, although the accuracy with which actual depreciation would be covered would be at best approximate, and not gauged by the extreme accuracy with which the percentage on the reducing balance is calculated from the formula.

Interest

The interest question in depreciation has a twofold aspect. On the one hand, it has been asserted that the actual cost of an investment is not merely the bare original investment itself, but an additional amount represented by interest on the investment, since the money thus invested might have been loaned out on security at a fair rate of interest. This theory has given rise to the so-called "annuity method."

On the other hand, interest has been brought into the discussion of depreciation in connection with the establishment of sinking funds for the replacement of depreciated industrial plant. The "sinking fund" plan and those which are based upon the sinking fund principle, viz., the "equal annual payment" and the "unit cost" plans, require interest calculations of this character.

The Sinking Fund Method

The persistence with which the sinking fund method has been advocated makes a careful consideration of it necessary. The sinking fund formula provides a mathematically accurate method of accumulating a certain sum of money in a given time by means of equal periodic contributions permitted to accumulate at compound interest. Since such a fund grows not merely by the equal annual or other periodic additions made to it, but also by the interest accumulations of these additions, it follows that as the time during which the sinking fund accumulates is longer or shorter, so the portion of the entire fund formed exclusively by interest accretions will be larger or smaller. Thus, a fund of $100 accumulated in 25 years, interest at 5 per cent by equal annual contributions, is composed of $47.62 interest accumulations and $52.38 direct contributions to the fund. For a shorter period the total interest accumulation would be less, and for a longer period greater, than that given above.

From this, one might conclude that the cost of creating a fund grows smaller with the increase in the number of years, since the total contributions necessary to secure a fund of $100 in 25 years on a 5 per cent basis is only $52.38, while for longer periods it is yet smaller. The fallacy of this supposition is evident, however, if we remember that the equal periodic contributions to the fund are altogether withdrawn from the business, where they would have been employed at a profit, and that the longer such sums are held impounded in the fund, the longer the business is deprived of their use. Indeed, the business is not a very flourishing one if it cannot earn more by retaining these amounts in the business than can be secured in the form of interest accretions to them in a sinking fund.

The interest accumulations of a given year must be added to the annual contribution to the fund, to discover the actual burden for that year. Since the interest accumulations progressively increase, as may be seen by a glance at the table on page 154, the actual burden of the fund also increases yearly. In the foregoing illustration, it is more than three times greater in the last than in the first year.

There is no reason to suppose that depreciation increases at such a progressive rate. Moreover, the money should in most cases be reinvested in the business where it can be most profitably employed. The considerations which will make this plan the advisable one to follow must be such as are not usually confronted in practice. The seemingly great accuracy with which the calculations can be made ought not to blind us to the essential phases of the plan.

Interest on Investment—Annuity Method

At first thought there appears to be some reason for including an allowance for interest on the depreciated investment, since the money thus invested would ordinarily produce an income when loaned on security, and without the risks incident to the investment. In reality, however, the net profits of business are usually composed of two parts not readily distinguished: (1) interest on the investment at say 2 or 2½ per cent, about the rate paid on gilt-edge government bonds; and (2) over and above this, a reward for the extra hazards and risks of the business.

Briefly, a portion of the net profits represents interest on investment, and it would be a duplication of the interest charge to include it in the depreciation allowance. An inspection of the table on page 161 will show that the total amount charged in the case of a $100 property with a lifetime of 25 years is $177.38, being made up of 25 equal annual charges of $7.0952. This is nearly twice the amount of the original investment, and the continued reservation of amounts on this basis would return not only the capital invested but a large additional amount, its magnitude depending on the interest rate and the lifetime of the property. This is equivalent to an actual reservation of profits, which is not the purpose of the depreciation allowance.

There is yet another objection to this method. As the reader will see by an inspection of the table on page 161, and of Form 9 on page 162, the equal annual charges are composed of both interest and depreciation charges, the depreciation charge increasing with, and being dependent upon, the decreasing interest charge. The depreciation charge is thus made the function of an assumed rate of interest, with the result that, in the case of the $100 property with a lifetime of 25 years, the charge for depreciation in the 25th year is $6.76 as contrasted with $2.10 in the first year. There would appear to be no reason whatever for such a procedure, for the property would, in theory, not only be required to pay a return on the remaining investment as at the beginning of the 25th year, amounting to $6.76, but in addition earn a sufficient amount during the year to amortize its entire value.

When one invests money in an industrial plant he expects a return equal to the ordinary rate of interest plus a reward for entrepreneur's profit, risk, etc. If money can be loaned on good security for 5 per cent, by investing it in business one expects a return to cover not only interest which he might have received, but also a percentage for his extra labor and risk.

Should interest on investment be included in the depreciation charge, the balance of the revenue account will be correspondingly reduced, representing the gain over and above interest, or what may be termed "extra-interest" returns. If the money invested has been borrowed, and the same rate is allowed in the depreciation charge for interest as is paid on the money borrowed, then, provided the loan could be paid off as fast as the investment is reduced, the total charge for depreciation and interest on investment would be just sufficient to pay the loan and the interest thereon. Interest on borrowed money is a legitimate expense, but it should be considered under the head of interest, not of depreciation.

In a public utility whose rates are controlled by a commission, these rates are fixed to afford a suitable income; and since the investor cannot both loan his money on security and at the same time invest it in stocks, the most he can ask is a return equivalent to the ordinary interest rate, plus reward for hazard, etc. Therefore, if a deduction from income is made for interest on investment, rates cannot be raised to provide it again in the profits. If an allowance for interest on investment is made in the depreciation charge, it amounts to the retention of a portion of the profits in the business without recognizing them as such.

The Equal Annual Payment Method

Although an actual sinking fund is not created, this method employs the principles of the sinking fund to determine the depreciation charge, by making it what the charge for a sinking fund would amount to for the period in question, plus a sum representing interest on the remaining investment. This may be seen by examining the table on page 166 and comparing its contents with those of the table on page 154. The result is that if the rate of interest on the imaginary sinking fund is the same as that on the investment, an equal annual charge is secured exactly the same as that obtained by the annuity method, as indicated in column 6 of the equal annual payment table (page 166), and column 5 of the annuity table (page 161). Moreover, since the sinking fund is entirely imaginary, there appears to be no objection to assuming the same rate of interest in both cases. When the interest rate on investment and in the imaginary sinking fund are the same, the net result of this plan in the illustration given is an excessive charge of $77.38, representing interest on investment. If the interest on investment is placed at 7 per cent instead of 5 per cent, it amounts to $208.33 for an investment of $100, with a lifetime of 25 years—more than double the proper charge.

Instead of bringing the depreciation charge into as close correspondence as possible with the actual reduction of plant values, it is made a function of the growth of a sinking fund, and an imaginary one at that, based on an assumed rate of interest; and in order to make the charges equal they are increased by an imaginary return on the remaining investment, with the result that the equal annual charges are out of all proportion to the actual expiration of plant value. By carrying the items to the third or fourth decimal point, an appearance of great accuracy is obtained, which in reality bears little or no relation to the conditions to which it is intended to conform.

Undoubtedly it would be better to write down plant value by the sinking fund method than to make no provision whatever for depreciation. But we must remember that any depreciation charge based on purely assumed grounds may be considerably at variance with the actual conditions.

The Unit Cost Method

For valuations, especially where there exists obsolescence or inadequacy, the unit cost plan, as advocated, contains much that is suggestive, although vitiated by the introduction of the sinking fund principle. It is based on the fallacy that the sum of the annuities necessary to amortize plant value constitutes the total cost of amortization, and, in so doing, underestimates such cost by the amount of the interest accretions to the sinking fund. Since the interest accumulations form a smaller proportional part of short-time funds than of long-time funds, the net result of the unit cost formula is to underrate the value of the old plant, for in equation (3), page 170,

$$\frac{Q + P + F + iV}{Y} = \frac{q + p + f + iv}{y}$$

in which F represents the annuity to a sinking fund necessary to amortize V, the cost of the new plant, in N years, while f represents the annuity to a sinking fund necessary to amortize v, the depreciated value of the old plant, during its remaining life of n years. The left-hand term of the equation is assumed to represent the average unit cost of the product, or service, of the new plant; while the right side of the equation is assumed to represent the average unit cost of the product, or service, of the old depreciated plant. This is true in neither case, however, because F and f, the respective sinking fund annuities, represent less than the actual burden of the sinking fund, as has been shown; but since the lifetime of the old plant is usually less than that of the new one, the tendency is to understate the real cost of the burden of the new plant more than that of the old one, because the annuity constitutes a smaller part of the burden of a sinking fund over long periods than over short periods.

Thus, an annuity of \$2.0952 will accumulate, at an interest rate of 5 per cent, to \$100 in 25 years; but \$2.0952 × 25 = \$52.38, only a little more than one-half of the entire accumulation. On the other hand an annuity of \$18.097 will in 5 years, at 5 per cent, accumulate to \$100, while the sum of the annual contributions will constitute far more than 52.38 per cent of the total, or $18.097 × 5, which amounts to $90.485.

Each year's annuity to the 25-year sinking fund represents but little more than one-half of the average burden of the fund; while each year's annuity to the 5-year fund represents over 90 per cent of the average annual burden of the annuity. The consequence is that, although cost of production is understated in both cases, it is understated to a greater degree in the case of a new plant than in that of a depreciated one. The net result, in the use of the formula given, is to understate the value of the old plant.

Actual Depreciation

In the illustrations of the different methods of depreciation in the following pages of this chapter, hypothetical cases have been assumed, in which plant value undergoes a gradual reduction from 100 per cent to salvage value, or zero. However, in reality an industrial plant, as a whole, does not depreciate in this way. In an extensive plant value remains fairly fixed, beyond a certain unavoidable diminution during the first decade or so of its existence, resulting from the aging of the plant as a whole. This general aging is termed "composite depreciation," and it amounts to possibly 15 or 20 per cent of total value, neglecting improvements. After a certain point has been reached, however, depreciation and replacement become fairly complementary. Only in case of the replacement of an extraordinarily costly asset would its cost create an excessive burden on the revenues. In a less extensive plant, or one composed of a few very expensive properties, replacement burden, unless properly provided for, might at times be excessive, and even disastrously so, and a method of caring for such costs should be contrived which is sufficiently simple to be workable and at the same time accurate and inclusive enough to be valuable.

Such a method should not be based upon the cost and estimated lifetime of the entire plant, as this would make it impossible to give due weight to variations in the different units composing the plant. Average lifetime of a plant is too indefinite a basis, and makes impossible the proper allocation of the depreciation cost to the output of the machine or unit of the plant to which it is incident. In so far as any of the formal methods described in the following chapters are to be advocated, it should be understood that it is only as they apply to the units into which the plant can be divided most readily, and not to the plant as a whole, which is too complex to serve as a suitable base for the calculation of depreciation.

Characteristics of the Straight-Line Method

This is the simplest of the several plans that have been suggested to determine theoretical depreciation and make proper allowance for it in the records. It is based on the assumption that if the investment in dollars and cents is divided by the number of years, or periods, of the lifetime of a property, the resulting quotient expresses the amount in dollars and cents which should be allowed each year to cover accrued depreciation and prevent the lessening of invested capital. Whether the best method or not, it is at once the least complicated and most easily understood. No interest computations of any kind are involved, either on the investment itself, as in the annuity and equal annual payment methods, or on the annual allowances, as in the sinking fund method.

THE STRAIGHT-LINE FORMULA.—Having given the investment, lifetime, and salvage value of a property, let V represent the investment, n the lifetime in periods, as years or months, and V^1 the salvage value. Then if we assume x to equal the amount of the equal annual charges, an equation may be formed as follows:

$$(1) \qquad x=\frac{V-V^1}{n}$$

If salvage value is zero, then:

$$(2) \qquad x=\frac{V}{n}$$

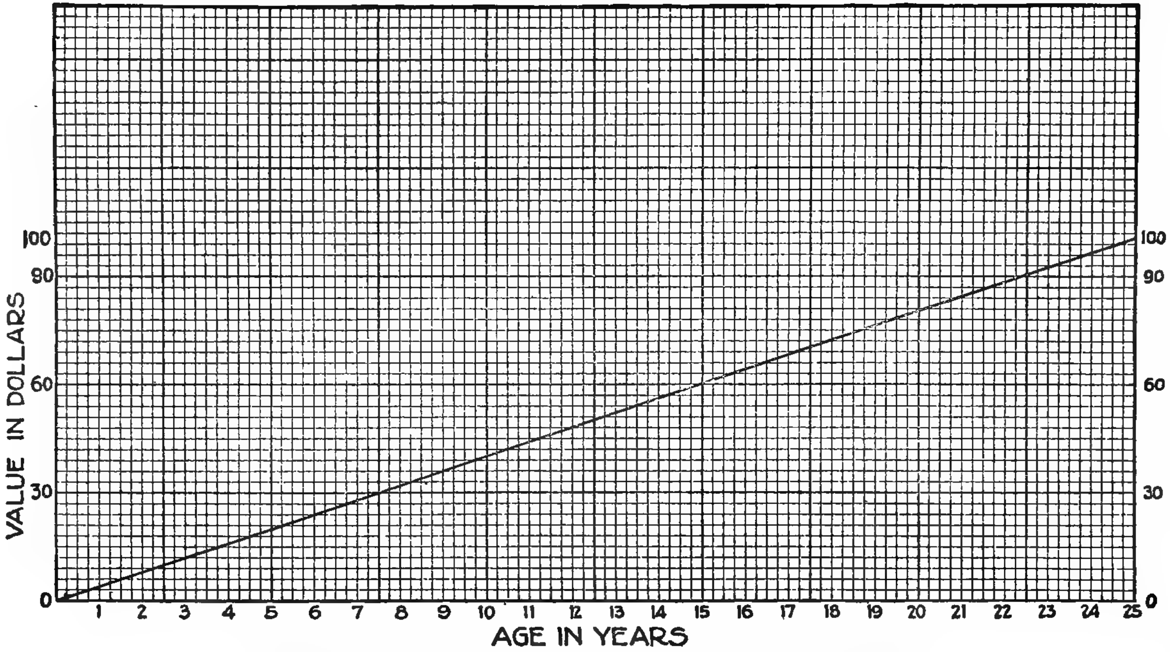
ILLUSTRATION OF STRAIGHT-LINE METHOD.—Assume the case of a plant costing \$100, having a lifetime of 25 years and a salvage value of zero. Substituting these values in formula (2), we have:

$$x=\frac{\$100}{25}=\$4$$

Four dollars, therefore, is the annual charge necessary to write off the investment in 25 years.

STRAIGHT-LINE TABULATIONS.—The accompanying table shows in detail the accumulations of the charges when made on this basis, and also the reduced theoretical value of the remaining investment at the end of each year. It is so simple as to require no explanation, and is given partly to make the treatment uniform with that outlined in the chapters which follow.

GRAPHIC ILLUSTRATION OF STRAIGHT-LINE METHOD.—Form 6 (page 143) is a graphic illustration of the straight-line method. The upward progress of the graph indicates value in dollars, while its progress from left to right represents time in years. Thus, at the end of the 10th year \$40, or 40 per cent of the investment, has in theory expired, and has been charged off in the income account as an expense of the business.



Form 6. Graphic Illustration of Depreciation—Straight-Line Method

Straight-Line Method

TABLE OF COMPUTATIONS

Age in Years	Value at End of Each Year	Depreciation During Year	Total Accrued Depreciation at End of Each Year
0	$100		
1	96	$4	$ 4
2	92	4	8
3	88	4	12
4	84	4	16
5	80	4	20
6	76	4	24
7	72	4	28
8	68	4	32
9	64	4	36
10	60	4	40
11	56	4	44
12	52	4	48
13	48	4	52
14	44	4	56
15	40	4	60
16	36	4	64
17	32	4	68
18	28	4	72
19	24	4	76
20	20	4	80
21	16	4	84
22	12	4	88
23	8	4	92
24	4	4	96
25	0	4	100
		$100	

Characteristics of the Reducing Balance Method

Assuming the plant to be a unit which depreciates from 100 per cent value to salvage value, the reducing balance method requires heavy charges during the first years of the plant's lifetime, these charges continually decreasing in amount from year to year. Since repairs and renewals cost least during the first years, increasing with more advanced years, they offset, to a certain extent at least, this inequality of charges, and tend to make the total cost of upkeep and depreciation more uniform than would otherwise be the case. If it were desirable to amortize a portion of the capital as the result of composite depreciation, by buying in part of the stock, and there were no legal obstacle in the way, funds accumulated as the result of the establishment of a reserve larger than necessary for replacements could be employed for that purpose. Or such funds might be used for the purchase of additional plant to compensate for composite depreciation in other portions of the plant. The undetermined financial status of newly established concerns sometimes affords cause for objection to this procedure, since, as sometimes unfortunately occurs, expediency may compel the payment of dividends to the sacrifice of the reserves. Theoretically, however, dividends cannot be paid until depreciation has been allowed; so that if the reducing balance method is assumed to represent depreciation, there will be no valid objection to it on the ground that it interferes with the declaration of dividends.

THE REDUCING BALANCE FORMULA.—The reducing balance plan charges off a constant percentage on the decreasing balance, beginning with the original investment and thus reducing it to salvage. This constant percentage must be such that at the end of a given number of periods, or years, the investment less salvage will have been written off. A formula for such a procedure will now be developed.

Assume that V^1 represents salvage value, V the original investment, n the number of periods, as years or months. Let the constant percentage necessary to reduce V to V^1 in n periods, by deducting for each period such percentage from the balance remaining over from the previous period, be represented by x. Since V represents the original value of the asset, then, theoretically, its value at the end of the first period will be $V(1-x)$.

To illustrate this theory, suppose we know that for a fixed number of years the percentage by which the balance must each year be reduced in order to reach salvage value in a stated number of years, is 37 per cent, or .37 of the reducing balance. Deducting .37 of the balance from the reducing balance is equivalent to multiplying the balance by 1 — .37, or .63. Thus:

$$(1) \qquad \$100 \times .37 = \$37; \quad \$100 - \$37 = \$63$$
$$(2) \qquad \$100 \times (1 - .37) = \$63$$

Since $V(1-x)$ is the first diminished balance, resulting from the deduction of the fixed percentage from the original investment, so $V(1-x)(1-x)$, or $V(1-x)^2$ is the diminished balance at the end of the second period, because $V(1-x)$, the balance at the beginning of the second period, must be reduced by the constant percentage, just as was V, the investment at the beginning of the first year, by multiplying it by $(1-x)$. $(1-x)$ therefore occurs twice as a multiplier, i.e., it is squared, and $V(1-x)(1-x)$ may be stated better as $V(1-x)^2$. At the end of the third period the balance must again be reduced by multiplying by $(1-x)$, and the resulting balance becomes $V(1-x)^3$. If n represents the given number of periods, then the balance at the end of the nth year will be $V(1-x)^n$, which, according to our assumption, must represent salvage value, or V^1. Put in form of an equation:

$$(3) \qquad V(1-x)^n = V^1$$

We can now find the value of x, the unknown percentage, in terms of the other quantities, all of which are known. Dividing both terms of the equation by V, which will not alter the equality, we get:

(4) $$(1-x)^n = \frac{V^1}{V}$$

Similarly we can take the *n*th root of both terms of equation (4) without altering the equality, thus obtaining:

(5) $$1 - x = \sqrt[n]{\frac{V^1}{V}}$$

According to a simple algebraic principle the signs of both terms of equation (5) may be changed from + to — or from — to + and the equality still preserved, thus:

(6) $$x - 1 = -\sqrt[n]{\frac{V^1}{V}}$$

Lastly, the equality is still preserved if in changing any quantity from one side of the equation to the other we simply change its sign. Thus we may obtain:

(7) $$x = 1 - \sqrt[n]{\frac{V^1}{V}}$$

which states the value of x in terms of time n, original investment V, and salvage V^1.

ILLUSTRATION OF REDUCING BALANCE METHOD.—Assume the case of an imaginary plant costing $100, and depreciating in 25 years to a salvage value of $1. Further, assume that the depreciation occurring each year is a constant percentage of the balance of the investment remaining at the beginning of the year. The problem is to find this constant percentage. Substituting our values in formula (7) we have:

$$x = 1 - \sqrt[25]{\frac{1}{100}}$$

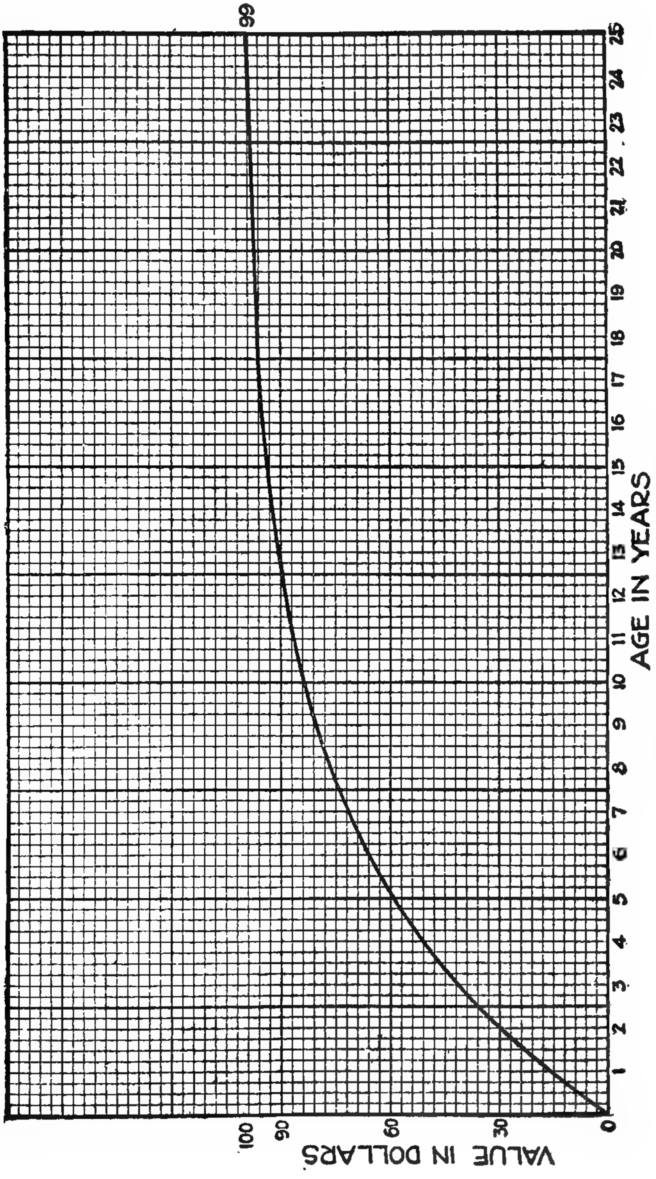
When solved the value of x is found to be .168236. The balance must therefore be reduced each year 16.8236 per cent.

Reducing Balance Tabulations.—In the table which follows are tabulated all the items in the problem, extending over a period of 25 years. The first column indicates the age of the plant; the second column the value of the balance at the end of each year, after having been reduced from the previous year by .168236; the third column each year's depreciation;

Reducing Balance Method

TABLE OF COMPUTATIONS

Age in Years	The Reduced Balance	Depreciation for Each Year	Amount of Depreciation from Beginning to End of Each Year
0	$100.0000	$16.8236	$16.8236
1	83.1764	13.9933	30.8169
2	69.1831	11.6390	42.4559
3	57.5441	9.6810	52.1369
4	47.8631	8.0523	60.1892
5	39.8108	6.6978	66.8870
6	33.1130	5.5708	72.4578
7	27.5422	4.6136	77.0714
8	22.9286	3.8574	80.9288
9	19.0712	3.2086	84.1374
10	15.8626	2.6687	86.8061
11	13.1939	2.2197	89.0258
12	10.9742	1.8462	90.8720
13	9.1280	1.5365	92.4085
14	7.5915	1.2772	93.6857
15	6.3143	1.0623	94.7480
16	5.2530	.8835	95.6315
17	4.3685	.7349	96.3664
18	3.6336	.6113	96.9777
19	3.0223	.5084	97.4861
20	2.5139	.4229	97.9090
21	2.0910	.3498	98.2588
22	1.7412	.2929	98.5517
23	1.4483	.2437	98.7954
24	1.2046	.2028	98.9982
25	1.0018		
		$99.0000	



Form 7. Reducing Balance Curve

(Plotted from data in first and last column of table on page 148.)

while the fourth column shows the total accrued depreciation to the end of each of the 1-year periods. From this it is seen that over 50 per cent has been written off in 4 years, and over 90 per cent at the end of the 13th year, or when the plant has barely passed middle age. The charges for the last few years are insignificant compared with the first one.

GRAPHIC ILLUSTRATION OF THE REDUCING BALANCE METHOD.—Form 7 indicates graphically the facts given in the table. Vertical spaces represent values, and horizontal spaces time, as designated. The rise of the curve indicates the accrual of depreciation upon the reducing balance theory. In the table, accrued depreciation at the end of the 6th year amounts to $66.89. This may be found approximately in the graph by noting what amount in dollars is diagonally opposite the 6-year point in the rectangle one of whose upright sides is determined by the intersection of the curve with the vertical line drawn from 6. The exact amount in dollars is not likely to be found, as it is indicated at only five points, 0, 30, 60, 90, and 100, each vertical space representing $3. However, the amount indicated by the curve for any given time can be read approximately.

Characteristics of the Sinking Fund Method

The sinking fund method derives its name from the fact that it employs the principles which are ordinarily used in the establishment of sinking funds for the liquidation of bonded indebtedness, as well as for purposes of replacement, etc. It might also be called the "compound interest method," since sinking funds accumulate by compound interest, and because it is sometimes employed without establishing an actual sinking fund, as in the equal annual payment method, considered on pages 163 to 168.

We must not forget that where the rate of depreciation is made a function of a rate of interest, such depreciation is purely theoretical, and may or may not approximate actual depreciation. Some confusion has resulted from attempting to indicate depreciation by means of interest formulas, with the result that such methods have been branded by some writers as illusory and misleading. The way to determine actual depreciation is by inspection. But this does not necessarily render useless, formulas which can be applied with due consideration of the facts in the case. The problem is one of expediency, and whatever plan will aid in a solution of the problem ought to be adopted.

By the sinking fund method a fixed sum of money is placed aside each period and allowed to accumulate at compound interest. The amounts thus set aside, plus their interest accumulations, must be such as to equal the desired amount at the end of an assumed period. Although the annual charges remain constant, the actual burden increases each period, because in addition to the equal amounts placed in the fund periodically, there are the continually increasing interest accumulations which represent the earning capacity of the fund and which are not received through the usual channels of revenue as they would be if the funds were reinvested in the business.

THE SINKING FUND FORMULA.—Assume an imaginary plant with a value of $100, lifetime of 25 years, and salvage value of zero. Our problem is to find what sum of money must be set aside each year in order that at the end of 25 years the fund will have accumulated to $100, at 5 per cent interest, compounded annually.

When a series of numbers increases or decreases by a constant factor, it forms a geometrical progression whose terms consist of the respective annual charges plus their interest accumulations at the end of the assumed period of years.

In the problem given it is evident that the last one of the 25 fixed payments will accumulate no interest, since it is made at the end of the 25th year, when the fund will be needed to make the desired replacement. The next to the last payment (24th) will accumulate interest for 1 year; while the one preceding this will accumulate not only 1 year's interest on the payment made to the fund, but also 1 year's interest on the sum of the 23rd payment after being enhanced by its first year's interest accumulation, and so on. Five per cent being the rate of interest, we obtain a series which increases by a constant factor (1.05), thus:

The last year the charge accumulates no interest, so it amounts to 1.00 times the charge.

Next to the last year the charge accumulates to 1.05 times the charge.

Second year from the last, the charge accumulates to 1.1025 (1.05 × 1.05) times the charge.

Third year from the last, the charge accumulates to 1.157625 (1.1025 × 1.05) times the charge, and so on, each year's charge accumulating to an amount 1.05 larger than the amount accumulated by the charge of the year following.

Thus the constant factor is 1.05 in the series consisting of the annual charges plus their interest accretions. Now, if we assume x to be the fixed annual payment necessary to produce the required sum, then $(x \times 1.05)$ is the accumulation of the next to the last year's payment; $(x \times 1.05^2)$ that of the preceding year; $(x \times 1.05^3)$ that of the next preceding; and so on. In this instance, $(x \times 1.05^{24})$ is the accumulation of the first payment invested. To secure a general formula let r represent the constant factor, and n the number of years. Then:

$$x + xr + xr^2 + xr^3 + xr^4 + \ldots + xr^{n-2} + xr^{n-1}$$

is the general form of the increasing geometrical progression.

The sum of these terms, or V, must equal the fund accumulated after n years, by investing x dollars in a fund accumulating at the rate of r. This sum is a known quantity, being $100 in the problem assumed. By a well-known mathematical principle,[2]

$$V = \frac{(xr^{n-1} \times r) - x}{r - 1} \tag{1}$$

$$\therefore V = \frac{xr^n - x}{r - 1} \tag{2}$$

$$\therefore V = \frac{x(r^n - 1)}{r - 1} \tag{3}$$

$$\therefore x = \frac{V(r - 1)}{r^n - 1} \tag{4}$$

ILLUSTRATION OF SINKING FUND METHOD.—Substituting in equation (4) the values assumed above, and solving by logarithms, we have:

$$x = \frac{\$100\ (1.05 - 1)}{1.05^{25} - 1} = \$2.0952+$$

That this amount set aside each year, at 5 per cent compound interest, for 25 years, will amount to $100, may be proved by using formula (3):

$$V = \frac{\$2.0952\ (1.05^{25} - 1)}{1.05 - 1} = \$100$$

Since in practice fractions smaller than 1 cent cannot be dealt with, the amount of each instalment would be $2.10. This, compounded at 5 per cent for 25 years, would slightly exceed $100, and would amount to $100.22.

SINKING FUND TABULATIONS.—In the table which follows, all figures secured in the solution of this problem are tabulated. The first column shows the age in years, the second column the value at the end of each year, the third column the equal annual payments to the depreciation fund, the fourth column the interest accumulations of the fund, and the fifth column the actual burden for each year secured by combining the results in the third and fourth columns.

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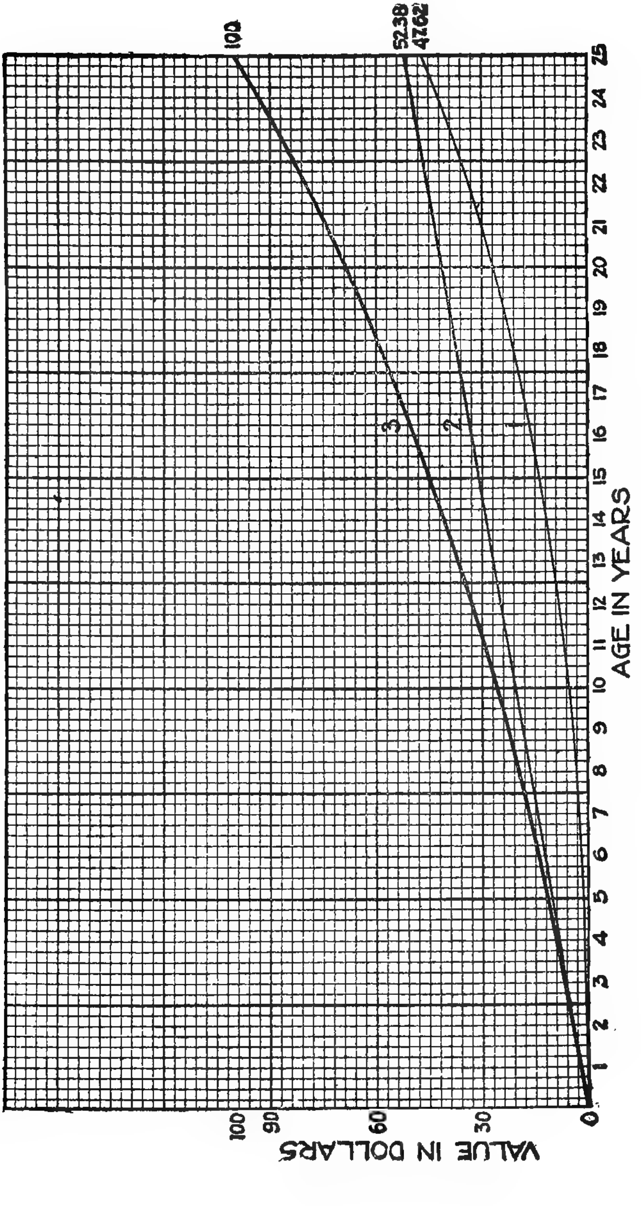
[2] To find the sum of the terms of a geometric series, multiply the greatest term by the ratio; from the product subtract the least term; divide the remainder by the ratio less 1.

SINKING FUND METHOD

TABLE OF COMPUTATIONS

Age in Years	Value at End of Year	Annual Payment to Sinking Fund	Annual Accretion of Interest in Sinking Fund	Actual Annual Cost, or Payment, Plus Year's Interest Accumulations
0	$100.0000			
1	97.9048	$2.0952	$0.0000	$2.0952
2	95.7074	2.0952	.1049	2.2001
3	93.3947	2.0952	.2148	2.3100
4	90.9693	2.0952	.3302	2.4254
5	88.4225	2.0952	.4516	2.5468
6	85.7483	2.0952	.5790	2.6742
7	82.9405	2.0952	.7126	2.8078
8	79.9923	2.0952	.8530	2.9482
9	76.9866	2.0952	1.0005	3.0957
10	73.6462	2.0952	1.1552	3.2504
11	70.2333	2.0952	1.3177	3.4129
12	66.6497	2.0952	1.4884	3.5836
13	62.8870	2.0952	1.6675	3.7627
14	58.9361	2.0952	1.8557	3.9509
15	54.7876	2.0952	2.0533	4.1485
16	50.4317	2.0952	2.2607	4.3559
17	45.8581	2.0952	2.4784	4.5736
18	41.0557	2.0952	2.7072	4.8024
19	36.0133	2.0952	2.9472	5.0424
20	30.7187	2.0952	3.1994	5.2946
21	25.1594	2.0952	3.4641	5.5593
22	19.3221	2.0952	3.7421	5.8373
23	13.1930	2.0952	4.0339	6.1291
24	6.7574	2.0952	4.3404	6.4356
25	0.0000	2.0952	4.6622	6.7574
		$52.3800	$47.6200	$100.0000



Form 8. Sinking Fund Curves
(Plotted from data on page 154.)

GRAPHIC ILLUSTRATION OF SINKING FUND METHOD.—The problem is solved graphically in Form 8. Curve 1 indicates the growth of the interest accumulations; 2 the equal annual charges (this is a straight line); and curve 3 the resultant of 1 and 2. Note that in this instance the interest accumulations, $47.62, are but slightly less than the payments to the fund, $52.38.

CHAPTER VIII

METHODS OF DEPRECIATION (CONTINUED)

Characteristics of the Annuity Method

This method bears some resemblance to the equal annual payment method (pages 163 to 168), as in both an allowance is made for interest on the investment remaining at the beginning of each period. Under the equal annual payment method the diminution of the investment is arbitrarily determined by assuming that the depreciation is equal to the gradual increase of a sinking fund based on a given rate of interest.

Similarly the annuity method proceeds on the assumption that interest on the remaining investment should be allowed for in the revenues; and also that the annual allowances should be equal, as is the case under the equal annual payment method when the rate of interest on the investment is the same as is assumed for the sinking fund.

Under the annuity method, however, the equal annual charge is determined without the assumption of any depreciation rate, by merely finding such a sum as, when deducted each year from the sum of the remaining investment and the interest thereon at a given rate, will write down the investment to salvage, or zero, and in addition return the full amount of the interest on the investment as it stands from beginning to end of the plant's life. Interest for the first year is on the original investment; for the second year on the original investment *reduced* by the amount that the total annual allowance for interest and depreciation is in excess of the interest on investment for the first year. Thus that part of the allowance covering the item of interest will gradually diminish, while that part covering depreciation will correspondingly increase, the two combined being always the same.

But, whereas under the equal annual payment method the amount of the depreciation, and consequently the remaining investment, depends upon the growth of a theoretical sinking fund, under the annuity method the controlling factor is the rate of interest on the investment. As the rate is lowered this method approaches nearer and nearer to the straight-line method, becoming identical with it when the interest is zero. Under the equal annual payment method the depreciation is made a function of the rate of interest upon which a sinking fund accumulates, while in the annuity method the depreciation is a function of the assumed rate of interest on the investment.

THE ANNUITY FORMULA.—The annuity plan charges off an equal amount each year sufficient to cover interest on the remaining investment, and in addition to reduce plant to salvage, or zero, at the end of a given time. Let V represent original value, V^1 salvage value, n the lifetime of the plant, and r the rate of interest plus 1.

Since V is the original value, Vr, that is, V multiplied by 1 plus the rate of interest, is the sum of the original investment plus interest on it for the first period. For instance, if the original value is \$100, and interest on investment is computed at 5 per cent, then \$100 × 1.05 (1 plus the rate of interest) equals \$105, or the original investment plus 1 year's interest.

If we let x represent the equal annual charge, the amount of which we are seeking, and which is just sufficient to return both principal and interest thereon at the given rate, then it is clear that the investment remaining after the first annual charge—and the investment at the beginning of the second period—will be $(Vr - x)$. Therefore, following the same procedure as before, the interest on the investment for the second period will be $(Vr - x)$ multiplied by 1 plus the rate of interest, or $(Vr - x)r$. From this in turn we deduct x, the second annual charge, which gives us the investment at the beginning of the third period, or $(Vr - x)r - x$, and so on for as many periods as necessary. Suppose the lifetime of the plant is four years, then:

$$\{[(Vr - x)r - x]r - x\}r - x = V^1 \tag{1}$$

Removing the first parentheses,

$$[(Vr - x)r - x]r^2 - xr - x = V^1 \tag{2}$$

Removing the second parentheses,

$$(Vr - x)r^3 - xr^2 - xr - x = V^1 \tag{3}$$

Removing the last parentheses,

$$Vr^4 - xr^3 - xr^2 - xr - x = V^1 \tag{4}$$

We next solve this equation for x, by first transferring Vr^4 to the opposite side of the equation, changing its sign, thus:

$$-xr^3 - xr^2 - xr - x = V^1 - Vr^4 \tag{5}$$

Changing the signs of all terms we have:

$$xr^3 + xr^2 + xr + x = Vr^4 - V^1 \tag{6}$$

Or,

$$x(r^3 + r^2 + r + 1) = Vr^4 - V^1 \tag{7}$$

Dividing both terms by $(r^3 + r^2 + r + 1)$,

$$x = \frac{Vr^4 - V^1}{r^3 + r^2 + r + 1} \tag{8}$$

Or,

$$x = \frac{(Vr^4 - V^1)(r - 1)}{r^4 - 1} \tag{9}$$

By substituting n for 4, a general formula is obtained, applicable to any number of periods, thus:

$$x = \frac{(Vr^n - V^1)(r - 1)}{r^n - 1} \tag{10}$$

Illustration of Annuity Method.—Assume an imaginary plant costing $100 and having a lifetime of 25 years. Assume further that the investment as at the beginning of each year should have a return of 5 per cent thereon. Substituting these known terms in our formula we have:

$$x = \frac{(100 \times 1.05^{25})(1.05 - 1)}{1.05^{25} - 1}$$

which when solved with the aid of logarithms gives $7.095245 + for the value of x, that is, the equal annual allowance that must be made to afford a return of 5 per cent on the investment, and also reduce the investment to zero at the end of the 25th year. Since the investment gradually decreases, the theoretical depreciation gradually increases, the sum of interest on investment plus depreciation allowance being always $7.095245 +. It should be noted that the same results are secured by this method as by the equal annual payment method when the rate of interest employed is the same as is used in the equal annual payment method, both for computing depreciation on a sinking fund basis and for computing interest on the investment.

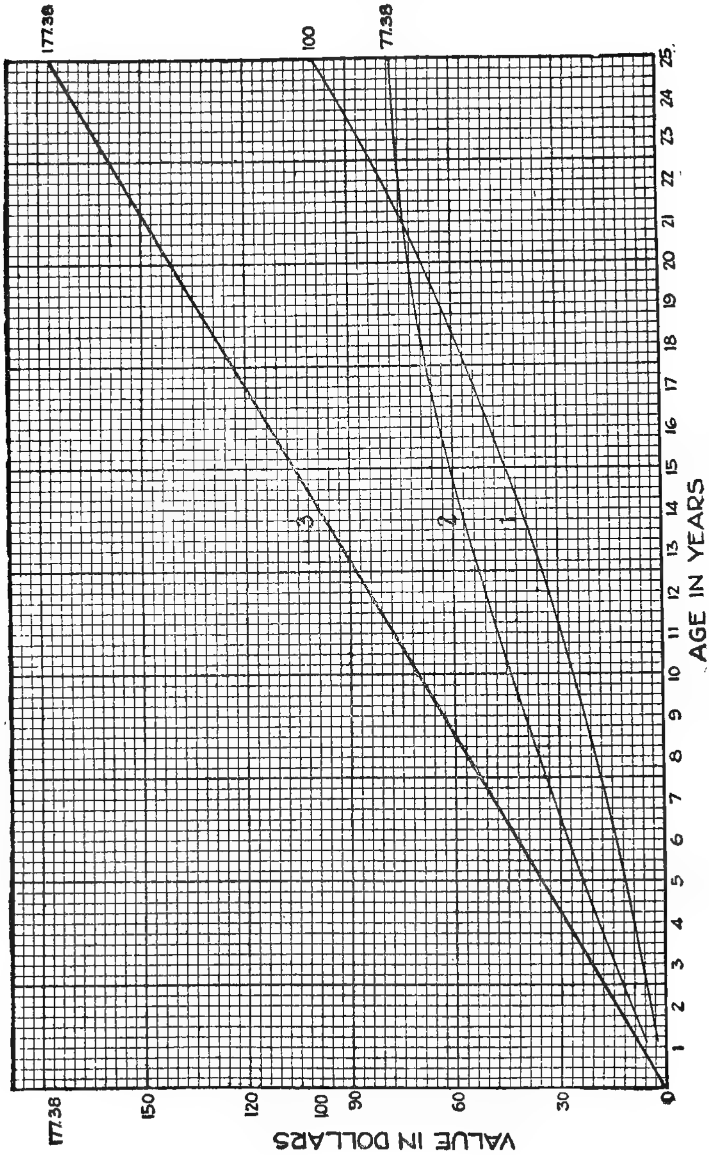
Annuity Tabulations.—The table which follows details the computations for the problem given above. The first column gives the age of the plant in years; the second column indicates the theoretical value at the end of each year; the third column gives the interest on the remaining investment each year; the fourth column gives the theoretical depreciation; and the items in the fifth column are formed by combining interest on investment and depreciation, which is the allowance for each year. The contents of the accompanying annuity table should be carefully compared with those of the equal annual payment table on page 166.

Graphic Illustration of Annuity Method.—This problem is illustrated graphically in Form 9. Curve 1 indi-

Annuity Method

TABLE OF COMPUTATIONS

Age in Years	Value at End of Year	Interest on Remaining Value of Property at 5%	Combined Depreciation Allowance	Depreciation Plus Interest on Investment
0	$100.0000			
1	97.9048	$5.0000	$2.0952	$7.0952
2	95.7047	4.8952	2.2001	7.0952
3	93.3947	4.7852	2.3100	7.0952
4	90.9693	4.6697	2.4254	7.0952
5	88.4225	4.5484	2.5468	7.0952
6	85.7483	4.4211	2.6742	7.0952
7	82.9405	4.2874	2.8078	7.0952
8	79.9923	4.1470	2.9482	7.0952
9	76.8966	3.9996	3.0957	7.0952
10	73.6462	3.8448	3.2504	7.0952
11	70.2333	3.6823	3.4129	7.0952
12	66.6497	3.5116	3.5836	7.0952
13	62.6462	3.3325	3.7627	7.0952
14	58.9361	3.1443	3.9509	7.0952
15	54.7876	2.9468	4.1485	7.0952
16	50.4317	2.7394	4.3559	7.0952
17	45.8581	2.5216	4.5736	7.0952
18	41.0557	2.2929	4.8024	7.0952
19	36.0133	2.0528	5.0424	7.0952
20	30.7187	1.8006	5.2946	7.0952
21	25.1594	1.5359	5.5593	7.0952
22	19.3221	1.2580	5.8373	7.0952
23	13.1930	.9661	6.1291	7.0952
24	6.7574	.6596	6.4356	7.0952
25	0.0000	.3379	6.7574	7.0952
		$77.3800	$100.0000	$177.3800



Form 9. Annuity Curves
(Plotted from data on preceding page)

cates the depreciation; curve 2 the interest on the investment; and the straight line 3 shows the resultant of curves 1 and 2.

Characteristics of the Equal Annual Payment Method

This method[1] has been devised for the purpose of securing an equalized depreciation charge, and thus a uniform investment cost. By investment cost is meant that part of the cost of the output which arises from the investment in the industrial plant, without which operations could not be carried on. Investment cost will depend upon the amount of capital sunk in the enterprise and the rapidity with which it is exhausted. Thus, if a plant capable of turning out 1,000 units of a uniform product each year for 10 years, costs $10,000, then the investment cost per unit is $1, ignoring interest. If the $10,000 invested in the plant is worth 6 per cent interest, then the total investment cost is $10,000 plus the interest on that amount for 10 years at 6 per cent, or $16,000. This assumes that the total investment remains in the plant. If at the end of each year a portion of the investment is returned, as it should be under a proper system of charging for depreciation or exhausted capital outlay, the interest charge on the remaining investment will decrease each year in proportion to the amount of the investment so amortized, and the interest plus the investment will be considerably less than $16,000.

In theory this equal annual investment charge would be secured when, taking into consideration the interest cost on the continually decreasing investment, an equal annual charge is made against revenue that will cover both depreciation of the remaining investment and the interest cost incident to such investment.

Assume the case of a property costing $100, having a lifetime of 25 years. The money invested has been borrowed at

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[1] Suggested by the Special Committee on Valuation of the American Society of Civil Engineers, in their tentative report of Dec. 31, 1913.

5 per cent interest. To simplify matters we shall for the present neglect salvage value and repairs. How can we determine the equal annual investment cost and therefore the annual depreciation charges to cover such cost, so that out of such charges the investment can be amortized and interest at 5 per cent paid on the continually reducing investment? That is, instead of waiting until the end of the 25th year to repay the loan of $100, a payment is to be made thereon each year of a sum representing depreciation during the year plus interest on the investment as at the beginning of the year. The reduction of the interest charge will depend on the rapidity with which the investment theoretically depreciates and is amortized through the annual charges. Since interest cost gradually diminishes, it follows that to make the charge equal from year to year the depreciation must correspondingly increase.

Illustration of Equal Annual Payment Method.—The sum which must be placed in a sinking fund each year so that such annual payments plus their accumulations at 5 per cent compound interest will amount in 25 years to $100, is, according to the formula explained on pages 151 to 153, $2.0952 +. By the equal annual payment method, instead of establishing a sinking fund, each annual depreciation charge is made equal to what the annual payment to a sinking fund plus the interest accumulations for that year would have amounted to had such a fund been established. In the third column of the table which follows, the depreciation for each year is assumed to be equal to the annual increase of a sinking fund into which annual payments of $2.0952 + are made and allowed to accumulate at 5 per cent interest, thus amounting to $100 at the end of 25 years. These amounts, when deducted from the amount invested as at the beginning of each year, give the remaining investment upon which interest for the next year is computed. The return on the remaining investment as at the beginning of each year is shown in the fourth column at 5 per cent, and in the fifth column at 7 per cent. The sixth and seventh columns show the depreciation and interest on the remaining investment combined. It is only when the same rate of interest is assumed for computation of the depreciation by the sinking fund method and for the interest on the remaining investment, that the amount of the two when combined remains a constant quantity.

Since a sinking fund is not really established, the following question arises: What is to determine the rate of interest to be employed in making the computation of the depreciation? This leads to a consideration of what appears to be the leading defect of the method, viz., that the amount of the depreciation, and consequently the amount of the remaining investment, is assumed to be dependent upon the laws of compound interest. There is no ground whatever for such an assumption, and if property depreciates to the same extent that a sinking fund accumulates, it is due merely to a coincidence, and one which it is safe to say never occurs in reality. This, however, does not necessarily negative the value of the plan, which, it would appear, might—after a careful comparison of the various sinking fund curves with actual conditions, to find what one most nearly approximates such conditions—be of much value in determining what a uniform or nearly uniform charge would be.

EQUAL ANNUAL PAYMENT TABULATIONS.—In the table which follows are given all the tabulations illustrative of this plan for an investment of $100, having a lifetime of 25 years, with depreciation based on a sinking fund accumulating at 5 per cent compound interest, and returns of 5 and 7 per cent, respectively, on the remaining investment. The items in the sixth column are formed by combining the items of the third and fourth columns, while the items in the seventh column

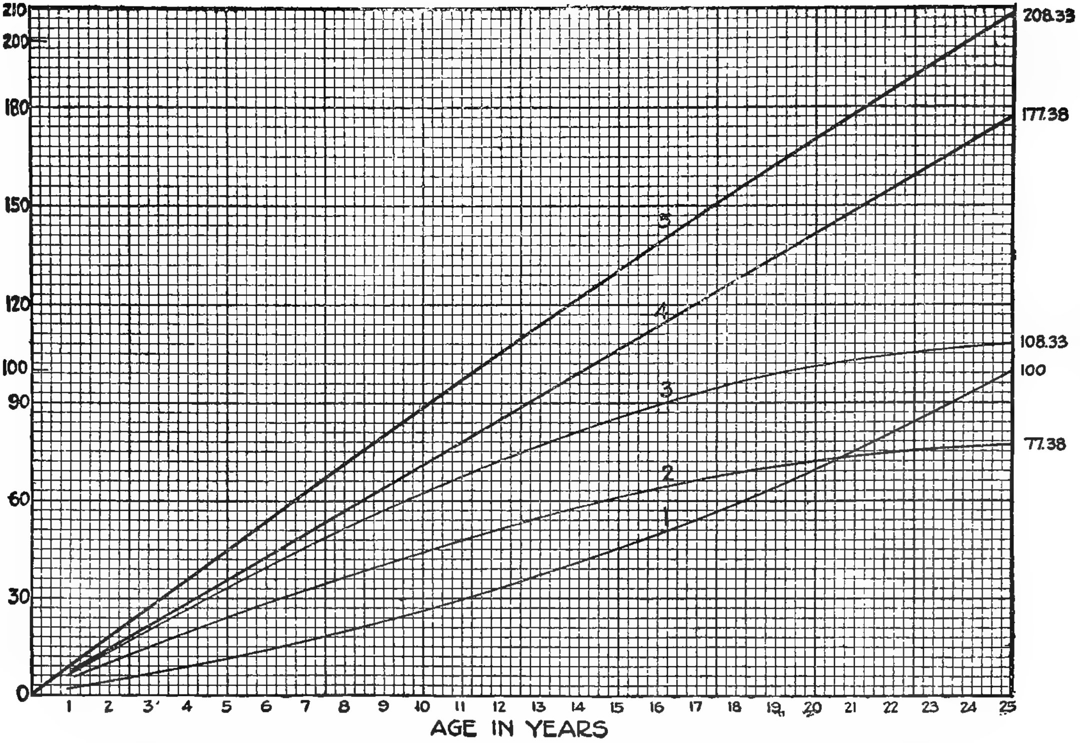
Equal Annual Payment Method

TABLE OF COMPUTATIONS

Age in Years	Value at End of Year	Depreciation During Year	Return on Remaining Value of Property at: 5%	Return on Remaining Value of Property at: 7%	Combined Depreciation and Return Upon Investment at: 5%	Combined Depreciation and Return Upon Investment at: 7%
0	$100.0000					
1	97.9048	$2.0952	$5.0000	$7.0000	$7.0952	$9.0952
2	95.7047	2.2001	4.8952	6.8533	7.0953	9.0534
3	93.3947	2.3100	4.7852	6.6993	7.0952	9.0093
4	90.9693	2.4254	4.6697	6.5376	7.0951	8.9630
5	88.4225	2.5468	4.5484	6.3679	7.0953	8.9146
6	85.7483	2.6742	4.4211	6.1896	7.0953	8.8638
7	82.9405	2.8078	4.2874	6.0024	7.0952	8.8102
8	79.9923	2.9482	4.1470	5.8058	7.0952	8.7540
9	76.8966	3.0957	3.9996	5.5995	7.0953	8.6952
10	73.6462	3.2504	3.8448	5.3828	7.0952	8.6332
11	70.2333	3.4129	3.6823	5.1552	7.0952	8.5681
12	66.6497	3.5836	3.5116	4.9163	7.0952	8.4999
13	62.8870	3.7627	3.3325	4.6655	7.0952	8.4282
14	58.9361	3.9509	3.1442	4.4021	7.0952	8.3530
15	54.7876	4.1485	2.9468	4.1255	7.0953	8.2740
16	50.4317	4.3559	2.7394	3.8351	7.0953	8.1910
17	45.8581	4.5736	2.5216	3.5302	7.0952	8.1038
18	41.0557	4.8024	2.2929	3.2101	7.0953	8.0125
19	36.0133	5.0424	2.0528	2.8739	7.0952	7.9163
20	30.7187	5.2946	1.8006	2.5209	7.0952	7.8155
21	25.1594	5.5593	1.5359	2.1503	7.0952	7.7096
22	19.3221	5.8373	1.2580	1.7612	7.0953	7.5985
23	13.1930	6.1291	.9661	1.3525	7.0952	7.4816
24	6.7574	6.4356	.6596	.9235	7.0952	7.3591
25	0.0000	6.7574	.3379	.4730	7.0953	7.2304
		$100.0000	$77.3800	$108.3300	$177.3800	$208.3300

are formed by combining the items of the third and fifth columns.

GRAPHIC ILLUSTRATION OF EQUAL ANNUAL PAYMENT METHOD.—In Form 10 these facts are indicated graphically. Curve 1 represents depreciation; curve 2 represents return on



Form 10. Curves Illustrating Equal Annual Payment Method

(Plotted from data on page 166. The figures at left of curves indicate value in dollars.)

the investment at 5 per cent; curve 3 represents return on the investment at 7 per cent. The straight line 4 is the resultant of curves 1 and 2, while curve 5 represents the resultant of 1 and 3. Note that while 4 is a straight line, 5 is slightly curved, owing to the slightly decreasing charge, as shown in the seventh column of the table.

Characteristics of the Unit Cost Method

This is a modification of the sinking fund method, based, its advocates claim, on the proposition that decrease of plant value is determined by increased cost of service or output, and may result either from obsolescence or actual physical depletion. It is claimed by the advocates of the unit cost method that the sinking fund formula is not of a sufficiently general type to take into consideration all the factors which enter into the problem, as, for example, the loss in economy resulting from the use of an old machine. The unit cost method, it is said, takes into consideration these factors, being based on the principle that the true price of a second-hand machine is such that during its remaining life the cost of output will be the same as during the life of a new machine.

THE UNIT COST FORMULA.—The unit cost formula is developed on the basis of value applicable to a given depreciated machine, and on value applicable to a new machine. That is, by making a comparison of a worn and a new plant on the basis of known or assumed facts, their relative values are found to be such that a unit of output will cost the same for the old as for the new machine. To accomplish such a result it is necessary to take into consideration the following factors: (1) the cost of amortizing the new machine; (2) the depreciated value of the old machine; (3) the average annual operating expenses, not including repairs, of both machines for their given lifetime; (4) the annuities which will be sufficient to provide repairs for both machines; and (5) the number of units of output which each machine is capable of producing. These values, for use in developing the unit cost formula, may be expressed as follows:

$V =$ first cost of new machine.
$v =$ depreciated value of old machine.
$F =$ sinking fund annuity to amortize V in its life of N years.
$f =$ sinking fund annuity to amortize v in its life of n years.
$N =$ lifetime in years of new machine.
$n =$ remaining lifetime in years of old machine.
$Q =$ average annual operating expense of new machine, not including repairs, during N years.
$q =$ average annual operating expense of old machine, not including repairs, during remaining lifetime of n years.
$P =$ annuity necessary to meet repairs of new machine during N years.
$p =$ annuity necessary to meet repairs of old machine during n years.
$i =$ rate of interest.
$U =$ average cost per unit of output of new machine for N years.
$u =$ average cost per unit of output of old machine for n years.
$Y =$ average number of units of output per annum of new machine during N years.
$y =$ average number of units of output per annum of old machine during n years.

The average unit cost for the old and new machines may be expressed thus:

$$U = \frac{Q + P + F + iV}{Y} \tag{1}$$

$$u = \frac{q + p + f + iv}{y} \tag{2}$$

According to our theorem, the unit cost of both old and new machines must be the same; therefore:

$$(3) \qquad \frac{Q+P+F+iV}{Y}=\frac{q+p+f+iv}{y}$$

According to formula (4) on page 153 relating to the sinking fund method, the V being dropped as it here equals 1, the sinking fund annuity necessary to accumulate \$1 in N years is:

$$(4) \qquad X=\frac{r-1}{r^N-1}$$

Substituting $(1+i)$ for r we have:

$$(5) \qquad X=\frac{i}{(1+i)^N-1}$$

Similarly the sinking fund annuity necessary to accumulate \$1 in n years is:

$$(6) \qquad x=\frac{i}{(1+i)^n-1}$$

To accumulate V dollars in N years will therefore require an annuity of:

$$(7) \qquad F=XV=\frac{iV}{(1+i)^N-1}$$

To accumulate v dollars in n years will require an annuity of:

$$(8) \qquad f=xv=\frac{iv}{(1+i)^n-1}$$

These values of F and f may now be substituted in equation (3), as follows:

$$(9) \qquad \frac{Q+P+XV+iV}{Y}=\frac{q+p+xv+iv}{y}$$

Equation (9) may now be solved for v, the depreciated value of the old plant. Multiplying both terms by y,

$$q + p + xv + iv = \frac{y(Q + P + XV + iV)}{Y} \tag{10}$$

Transferring $(q + p)$ to the opposite side by changing their sign,

$$xv + iv = \frac{y(Q + P + XV + iV)}{Y} - (q + p) \tag{11}$$

Since v is common to both items of the left-hand side of the equation, it may be written:

$$v(x + i) = \frac{y(Q + P + XV + iV)}{Y} - (q + p) \tag{12}$$

Dividing both terms of the equation by $(x + i)$ we have:

$$v = \frac{y}{x + i} \times \frac{(Q + P + XV + iV)}{Y} - \frac{q + p}{x + i} \tag{13}$$

Or, extending the parentheses to include $(q + p)$ by multiplying and dividing it by $\frac{y}{x + i}$ (thus leaving its value unchanged), we have:

$$v = \frac{y}{x + i}\left(\frac{Q + P + XV + iV}{Y} - \frac{q + p}{y}\right) \tag{14}$$

which is the general form of the unit cost formula. Values of X and x are calculated by the sinking fund formulas (5) and (6).

If the annual number of units of output of the old and new machines are the same, then $Y = y$ and equation (14) becomes:

$$v = \frac{Q + P + XV + iV - q - p}{x + i} \tag{15}$$

Or,

$$v = \frac{V(X + i) + (Q + P - q - p)}{x + i} \tag{16}$$

When the average annual operating expenses of the old and new plants are the same, $Q = q$ and the formula becomes:

$$(17) \qquad v = \frac{V(X+i) + (P-p)}{x+i}$$

When $(Q + P) = (q + p)$, the formula becomes:

$$(18) \qquad v = \frac{V(X+i)}{x+i}$$

which may be proved to be but another form of the sinking fund formula.

Illustration of Unit Cost Method.—Let $100 represent the cost of a unit of plant, with an estimated lifetime of 25 years, 5 years of which has expired. Let 5 per cent be the rate of interest on the investment, while the average annual operating expense, excluding repairs, is $50 a year. The annuity to provide for repairs during the remaining years is $12. When this plant unit was purchased it was clearly worth its full cost. With the passage of time, however, improvements are made, so that a machine of equal durability may be secured 5 years later at a cost of $100, which will turn out an average of 40 units per annum, at a reduction from $12 to $11 per annum for repairs, and from $50 to $48 for operating expense. Interest on investment remains the same. It is estimated that the old machine will turn out, on an average, 38 units per annum during the rest of its lifetime, 20 years.

If we substitute these values in formula (14), we have:

$$v = \frac{38}{.03024 + .05}\left(\frac{\$48 + \$11 + \$2.0952 + \$5}{40} - \frac{\$50 + \$12}{38}\right)$$

From this we find the value of v—which is the depreciated value of the old plant—to be $9.85.

The accuracy of the results secured by this method is commented on in pages 139 to 140.

The Production Method

During recent years production in some lines has been abnormally large while in others it has been unusually small;

moreover output has in some instances varied greatly from season to season and year to year. This situation has given rise to a demand for a method of charging depreciation to operation which will increase the charge with increased production and decrease it with decreased production, thus making the depreciation cost per unit fairly uniform regardless of the ups and downs of the market.

There is much to substantiate the reasonableness of such a demand. Experience has demonstrated the need for increased rates of depreciation when working two or more shifts per day, and the Treasury Department, for tax purposes, now recognizes the propriety of a depreciation charge made to fluctuate in harmony with fluctuations in production. The British Royal Commission on Income Tax granted application for special depreciation rates in certain cases where increase in output was shown to affect the producing instruments.

Objections to the Production Method.—At the outset it must be recognized that there are certain difficulties, theoretical as well as practical, in the application of this plan. The depreciation charge aims to return the cost of the asset less salvage, and this can be accomplished more easily when the return is secured by means of some mathematically determined method than when it is made to depend upon the fluctuations of production. In any event the future length of life of the asset in question is more or less uncertain, and when the production method is employed an additional element of uncertainty is introduced.

Notwithstanding these objections circumstances may be such as to give the production method a great appeal to the business man; while in some forms of industry it is the essentially correct method to pursue, regardless of market conditions. It reduces somewhat the heavy burden of fixed charges during periods of business depression when managers are struggling to keep afloat, and in so far as depreciation expense is actually reduced as the result of reduced activity the production method is theoretically correct.

Relation of Depreciation to Production.—Some forms of depreciation, however, continue to accrue at a rate which is little affected by production. Other forms of depreciation are more or less directly conditioned upon production; so that it is probably correct to say that depreciation costs decrease and increase as production decreases and increases, but not in the same ratio. In other words, the percentage of fluctuation of true depreciation cost from the normal is not as great as are the fluctuations of production from the normal or average production.[2] This means that, theoretically, at least, periods of subnormal production should be burdened with a depreciation charge which is smaller in total but larger per unit of output than that charged in periods of normal production, while the reverse would hold true for periods of excessive production.[3] Obsolescence and inadequacy are in no way related to production, while wear and tear is more or less directly a function of it, according to the nature and use of the asset in question. Without entering into the question of the advisability of considering obsolescence as a charge to operation, the following is of direct interest:[4]

> Does not light production warrant a scaling of depreciation? Are manufacturers not justified in minimizing their losses by adjusting depreciation charges to the flow of depreciation? Fifty per cent production does not warrant the abandonment of depreciation charges or even a 50 per cent reduction, if obsolescence proceeds irrespective of pro-

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[2] This statement does not apply to companies engaged in the exploitation of natural resources, such, for instance, as coal mining companies.

[3] When operations are carried on under very great pressure, as in time of war, this statement may not apply, because repairs cannot be made and machinery which is run under great strain deteriorates rapidly. In such cases the ratio of depreciation cost to production may be greater than under normal conditions.

[4] *Depreciation: Its Treatment in Production,* p. 10. Issued by the Chamber of Commerce of the United States, Washington, D. C.

> duction, but cannot a point be determined somewhere between 50 per cent and 100 per cent of the normal depreciation allowance which would correctly represent the situation of semi-normal production?

A. Lowes Dickinson suggests that the straight-line method of production lends itself readily to a "sliding scale adjustment by which, as is proper, the provision for depreciation may be varied in accordance with the amount of business done."[5] He does not enter into details, however, as to the method of preparing such a sliding scale.

The production method is better adapted to certain classes of assets than to others. Thus automobile trucks, delivery wagons, etc., can be conveniently depreciated on a per mile run basis. One company calculates depreciation on Ford automobiles used by salesmen at 2 cents per mile. It has found that for 30 cars the depreciation has averaged 1.9 cents per mile per car.

Certain problems arise when we undertake the work of allocating depreciation costs to output which fluctuates in a more or less erratic fashion with changing demands. Thus there are certain classes of assets which do not depreciate in harmony with the amount of output; in some instances it is conceivable that the rate of depreciation may vary inversely with the output. Thus if we may consider goodwill as an asset subject to depreciation it appears that periods of declining business indicate a more rapidly accruing depreciation cost, and vice versa. Again, certain kinds of furnaces may depreciate less rapidly if kept heated continually than if allowed to cool each day.

Depreciation an Element of Cost.—Yet it remains fundamentally true that the expense incurred by reason of the gradual wearing out of wasting assets through their use in furthering the processes of production is a part of the cost of production and is chargeable against the goods produced. Use of physical assets in production involves their deterioration and this means that ultimately these wasting assets must be replaced. Unless the proper amount of depreciation is added to cost, selling prices will not be placed sufficiently high to provide for ultimate replacement. However, the question in which we are primarily interested is not whether the product should be charged with depreciation, for this is now universally regarded as the correct procedure, but what rule should govern the allocation of depreciation to output over periods of varying productivity. In this connection two important points require consideration:

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[5] *Accounting Practice and Procedure*, p. 169.

1. To what extent does depreciation expense correspond in amount with the amount of output?
2. Is total depreciation expense incurred during periods of subnormal productivity a cost of manufacture, or should such part of total depreciation cost as is proportionate to idle time be charged directly to profit and loss? What ought the answer to this question to be if the total amount of depreciation charged off is made more or less dependent upon the amount of output?

1. It is evident that those assets which are employed directly in the productive processes are the ones which will be most affected by any changes in the rate of output. These include machinery, systems of power transportation, power plant, etc. Buildings might be affected if great pressure of productivity necessitating two or more shifts per day exists, but it is very doubtful whether the ordinary variations in the amount of the output have any appreciable effect on the rate of depreciation of buildings. Only in case of buildings which are subject to the vibrations of heavy machinery would the variations in output be a factor in increasing materially the rate of depreciation. In general it may be said that fixed assets

other than those employed directly in the productive processes should not be the subject of depreciation charges based upon the amount of the output. If, however, the depreciation is considered as a single rate on the entire plant the author is of the opinion that in no case, outside of certain excepted industries, should this rate be increased or decreased by more than 25 per cent of the normal amount to allow for the effects of overtime and idle time. Depreciation is not an inflexible fixed charge, but it is a fixed charge which can safely be diminished only within rather narrow limits, and a business man is merely delaying the day of settlement if, because of slow business, he cuts down the depreciation charge proportionately to the diminution in output in order to present a favorable income statement at the end of the year or in order to diminish the apparent cost of each unit of output.

2. Since the depreciation charge cannot be reduced proportionately to the reduction in output, each unit of output must be burdened with a proportionately greater depreciation cost, or else the excess above what would be charged against the reduced output were it charged with only its normal amount of depreciation must be charged directly to profit and loss. Were the amount charged to depreciation made strictly proportionate to output, then all depreciation should be charged to manufacturing. But we have shown that with decreased production the depreciation cost per unit of output is increased, and it follows that costs per unit will necessarily increase if the whole depreciation cost is allocated to cost of manufactured product. Here one of two possible theories of overhead must be applied. One group of accountants holds to the theory that overhead, although a fairly constant charge, must be spread over the cost of output regardless of the amount of output. Another group maintains that only that part of overhead should be applied to output in times of slack production as is found by multiplying the total overhead by a fraction whose

numerator is the actual number of hours worked and whose denominator is the normal number of hours, that is, the number that would be worked were there no idle time to be accounted for.

It is the writer's opinion that costs of manufacture should be standardized as far as possible and that therefore it is better to charge output of slack periods with only its normal overhead burden, the balance undistributed being carried direct to profit and loss. When this plan is pursued there is the danger, of course, of selling at prices which will not return operating costs plus profit, but this disadvantage is outweighed by the advantage of having cost figures which are standardized and which mean the same thing regardless of the total amount produced.

APPLICATION TO MINING COMPANIES.—Companies engaged in the exploitation of natural resources find the production method of writing off depreciation especially applicable to their peculiar conditions. Thus the National Coal Association has approved the statement of its committee on a standard system of accounting and analysis of cost of production to the effect that every coal mine consists of owned or leased coal deposits, plant, equipment, and development; that the cost of these factors differs in different instances; that they all depreciate together as the coal is exhausted; and that when the coal is exhausted or the right to the coal has elapsed, the plant and equipment have little value and the development is lost. Therefore, runs the committee's report:

> By dividing the cost of the mine by the total number of tons practically recoverable through present shafts and openings, the rate per ton necessary to redeem such cost will be found.
>
> In coal mining the exact unit for the measurement of work done is the ton of coal mined. It is also the exact unit

> for measuring depletion of mineral, wear and tear from use of equipment, and exhaustion of development. . . .
>
> A coal mine being, as emphasized, made up of several elements, all depreciating as the coal is mined, such depreciation is composite, accruing at a rate concurrent with the rate of extraction. The necessary rate per ton being determined, the aggregate depreciation for any accounting period should, of course, as far as practical, be distributed among the various elements in proportion to their respective costs or value.
>
> The doctrine that measures depreciation of coal mine plant and equipment in terms of time (excepting, of course, some leasehold propositions) is fallacious, as tested by the further assertion that a completely equipped mine could be maintained indefinitely without depletion or wear and tear if no coal were mined, by minor repairs.

This last assertion is certainly doubtful; nevertheless there is much in the nature of the mining business which substantiates the general theory contended for in this statement. When additions to plant and equipment become necessary an additional depreciation rate should be established based on the remaining estimated quantity of mineral yet to be extracted.

CHAPTER IX

LOGARITHMS AND THEIR USE

Computing Interest

Interest computations extending over long periods, as well as other calculations involving extended processes of multiplication and division, or the finding of powers and roots, are greatly facilitated by the use of logarithms. When, for example, it is necessary to compute the amount of an annuity, i.e., of a series of equal annual payments, of, let us say, $10 each, for a period of 30 years, accumulating at a rate of 6 per cent compound interest, the work of doing this by the usual arithmetical processes of multiplication and addition is exceedingly laborious.

Thus, the computations for the first three years are as follows:

First annual payment	$10.00
	×1.06
	6000
	1000
Amount at end of 1st year	$10.60
Add 2nd annual payment	10.00
Principal at beginning of 2nd year	$20.60
	×1.06
	12360
	2060
Amount at end of 2nd year	$21.836
Add 3rd annual payment	10.00

Principal at beginning of 3rd year	$31.836
	×1.06
	191016
	31836
Amount at end of 3rd year	$33.74616

One can readily see that to carry this on for the full 30 years would be a burdensome task. Hence a shorter method is desirable. It will be noted that the amount of the fund at the end of each year is obtained by multiplying it by the ratio of increase, 1.06, which gives the same result as is secured by first finding the interest by multiplying the principal at the beginning of each year by .06, and then adding this to the principal to find the amount at the end of the year. Therefore, if we wish to find the amount of $10 when placed at compound interest at 6 per cent for 30 years, our work will be abbreviated by first multiplying 1 by 1.06, 30 times, and then finding the product of $10 multiplied by the result, which may be expressed thus:

$$\$10 \times 1.06^{30}$$

In case of an annuity of $10 for 30 years the problem is somewhat more complicated, because there is not merely one sum of $10 accumulating at compound interest, but a series of annual instalments of that amount, each drawing interest. In a 30-year period, if the first of the 30 annuities is paid at the beginning of the first year, it will have a period of 30 years during which to accumulate. The last instalment will be paid at the beginning of the 30th or last year, and each one will draw interest; but since the last one has only one year during which it will accumulate, its interest is not compounded.

On the other hand, if the first of the 30 annuities is paid at the end of the first year, it will have not 30, but 29 years during which to accumulate, and the last annuity, being paid at the end of the 30th year, accumulates no interest at all. This is an important distinction, and, as depreciation allowances for the year must be made as of the end of the year and not at the beginning—for the depreciation accrued during the year—calculations must in such a case be based on the fact that the last annuity bears no interest and the first one bears interest from the end of the first, or, what amounts to the same thing, from the beginning of the second year. This must be kept in mind in the discussion of the sinking fund formula on page 151.

Assuming, then, that the first of the annuities or instalments of \$10 each, begins to accumulate interest at the end of the first year, at 6 per cent, it is evident that it will accumulate interest for 29 years, and will amount to:

$$\$10 \times 1.06^{29}$$

Similarly the next annuity will accumulate to:

$$\$10 \times 1.06^{28}$$

and so on, until we come to the next to the last instalment, which will accumulate to:

$$\$10 \times 1.06$$

and the last one, which will have no time to accumulate any interest whatever. Briefly, each annuity accumulates to 1.06 times the amount to which the one immediately following accumulates. Thus we have a series of amounts, increasing or decreasing by a common ratio, depending upon which way we view it, exactly the same as the series discussed on page 153, whose sum, V, is expressed by the following formula:

$$V = \frac{x(r^n - 1)}{r - 1}$$

in which x is the annuity, r is 1 plus the rate of interest, and n the number of years. Therefore the accumulations, at compound interest, of an annuity of $10, for 30 years at 6 per cent, the first annuity being paid at the end of the first year, is expressed thus:

$$\frac{10(1.06^{30} - 1)}{1.06 - 1}$$

Principle of Logarithms

A short method of making the computation indicated by 1.06^{30}, which is read as "1.06 raised to the 30th power," or simply as "1.06 to the 30th power," will be found in the use of logarithms. To understand this use a study of the underlying principle upon which logarithms are based will be necessary.

We can raise any number to any desired power by multiplying itself by itself the required number of times; thus 2^3 means $2 \times 2 \times 2$, or 8; 3^4 means $3 \times 3 \times 3 \times 3$, or 81; 4^4 means $4 \times 4 \times 4 \times 4$, or 256, and so on. From what has just been said the following is self-evident:

3	to	1st	power	is	3
3	"	2nd	"	"	9
3	"	3rd	"	"	27
3	"	4th	"	"	81
3	"	5th	"	"	243
3	"	6th	"	"	729
3	"	7th	"	"	2,187
3	"	8th	"	"	6,561
3	"	9th	"	"	19,683
3	"	10th	"	"	59,049

and so on. The numbers in the second column are the indices, indicating the power to which 3 is raised to secure the number in the third column. Thus, $3^9 = 19{,}683$; $3^5 = 243$.

Now suppose that we desire to multiply 243 by 81. By ordinary multiplication,

$$243 \times 81 = 19{,}683$$

From the foregoing table it may be seen that $243 = 3^5$, and $81 = 3^4$. By a principle of mathematics known as the law of indices,

$$3^5 \times 3^4 = 3^{5+4} = 3^9$$

That is, 3^5 is multiplied by 3^4 by simply adding together the indices. That this is correct may be seen by a glance at the table. There we find that 3^9 equals 19,683, as we have already found by multiplication. Conversely,

$$243 \div 81 = 3^5 \div 3^4 = 3^{5-4} = 3^1 = 3$$

for 3 raised to the 5th power is 243, and this amount, 243, divided by 3^4, or 81, gives 3. Thus, in a very simple way, we have substituted addition and subtraction for multiplication and division.

Let us suppose further that we desire to extract the square root of 59,049. As will be seen from the table, this is 3 raised to the 10th power, or 3^{10}. The square root of 59,049 is therefore the same as the square root of 3^{10} According to the law of indices, dividing the index of a number by 2 is equivalent to extracting the square root. Therefore, $3^{\frac{10}{2}}$, or 3^5, is the square root of 3^{10}. According to our table $3^5 = 243$. That this is the square root of 59,049 may be seen by multiplying 243 by 243, which equals 59,049. By reversing the procedure a number may be raised to any power by simply multiplying its index by that power. Thus 243, or 3^5, may be squared by multiplying 5, the index of 3, by 2; thus

$$243^2 = 3^{5\times2} = 3^{10} = 59{,}049$$

Similarly

$$27^3 = 3^{3\times3} = 3^9 = 19{,}683$$

The Logarithm

In the table given on page 183, the numbers in the second column are said to be the logarithms of the numbers in the third column to the base 3. In other words, the logarithm of a number is the power to which its base must be raised to produce that number. Thus, 8 is the logarithm of 6,561 to the base 3, and 2 is the logarithm of 9 to the base 3.

We have here selected the number 3 as a base. Any number may be so employed. The number 10 is the base usually taken, and forms the basis of the common system of logarithms.[1] Therefore common logarithms of numbers are indices indicating the power to which 10 must be raised to equal those numbers, just as in our table they were indices of 3.

Since most numbers are not integral powers of 10, it follows that their logarithms are integers only in the rare cases that they are integral powers of 10. Thus, $10^2 = 100$; therefore 2 is the logarithm of 100 to the base 10. Similarly 3 is the logarithm of 1,000 to the base 10, and 4 is the logarithm of 10,000 to the base 10. But the logarithm of 500 must be something more than 2 and less than 3; that is, it is 2 plus a decimal.

A 5-place logarithm table gives this decimal part of the logarithm to five points, as	.69897
A 6-place table gives it as	.698970
A 13-place table gives it as	.6989700043360
A 20-place table gives it as	.69897000433601880479

Usually the last figure is not exactly correct, being approximated or rounded off just as we round off $18.217 to $18.22.

The Characteristic

The integral part of a logarithm is known as the characteristic of the logarithm. Thus the logarithm of 500 to the sixth place is 2.698970, and therefore the characteristic of the logarithm of 500 is 2. Similarly the characteristic of the logarithms of all numbers from 100 to 999, inclusive, is 2; for the logarithm of 100 is 2, the logarithm of 999 is 2.999565, and the logarithms of all numbers between 100 and 999 lie between 2 and 2.999565.

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[1] Any good table of common logarithms such as those appearing in mathematical textbooks may be referred to in connection with the problems presented in this volume.

The logarithm of 1,000 is 3, for $10^3 = 1,000$. The logarithm of 9,999 is 3.999957. Therefore the characteristic of the logarithms of all numbers from 1,000 to 9,999 is 3, and so on. It will be noted that the characteristic of any logarithm is determined by the position of the decimal point in its number, being independent of the digits of the number. Thus, the characteristic of the logarithm of 7, which has one unit figure, is zero; of the logarithm of 77.77, which has one figure to the left of the unit place, is 1; of the logarithm of 9.3, with one unit figure, is 0; of the logarithm of 3,742.17, with three figures to the left of the unit place, is 3; of the logarithm of 56,689.778, with four figures to the left of the unit place, is 4; and so on. Hence, to find the characteristic of the logarithm of a number, this rule is given:

To find the characteristic of the logarithm of a number, find how many places the first significant figure is removed from unit's place. This determines the characteristic, and it is positive or negative (plus or minus) accordingly as the first significant figure is to the left or right of unit's place. Thus:

Characteristic of the logarithm of	1.0	is 0
" " " " "	0.1	" $\bar{1}$ (minus 1)
" " " " "	22.0	" 1
" " " " "	.0222	" $\bar{2}$
" " " " "	275.0	" 2
" " " " "	.0004	" $\bar{4}$
" " " " "	1,785.27968	" 3

The Mantissa

The mantissa of the logarithm of a number is the decimal portion, and does not depend upon the location of the decimal point but upon the digits of which the number is composed. Thus, while the characteristics of the logarithms of 999, 99.9 and 9.99 are 2, 1, and 0, respectively, the mantissa is the same for all, viz., .999565. Again, the characteristic of the logarithms of 327, 729, and 211 is 2 in each case, but the mantissas are .514548, .862728, and .324282. While the characteristic is positive or negative, depending upon the position of the decimal point, the mantissa is always positive. The mantissa is found by the use of a table of logarithms.

Finding the Logarithm of a Number

The number being given, its logarithm is determined by first finding the characteristic by the rule given. The mantissa is found from a table of logarithms, as follows:

1. When the number is composed of not more than four figures:

In the first column of the table of logarithms find the first two or three or four figures of the number (according to the table used), then follow across on the same line until the column is reached headed by the same figure as the last digit in the number whose logarithm we wish to find.[2] The decimal so found is the mantissa. To avoid repetition in the table, the first two (sometimes three or four) figures of the mantissa are printed at intervals only, in the second column.

Find log 37.53. By the rule the characteristic is 1. In the first column of the table of logarithms, find 375, and on the same line in the column headed by last digit 3, is found the mantissa .574379. As the characteristic is 1, the logarithm of 37.53 is 1.574379. Similarly:

log 727.4 = 2.861773
" 3256.0 = 3.512684
" 7274.0 = 3.861773

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[2] A 6-place table is employed in the computations which follow.

2. When the number is composed of more than four figures:

By glancing at the table of logarithms it will be seen that, within certain limitations, the numbers are proportional to their logarithms, and vice versa. Thus:

$$\left.\begin{array}{l} \log 4290 = 3.632457 \\ \ 4291 = 3.632559 \end{array}\right\} \text{difference is } .000102$$

$$\left.\begin{array}{l} \text{“}\ \ 4291 = 3.632559 \\ \text{“}\ \ 4292 = 3.632660 \end{array}\right\} \quad \text{“} \qquad \text{“} \quad .000101$$

$$\left.\begin{array}{l} \text{“}\ \ 4292 = 3.632660 \\ \text{“}\ \ 4293 = 3.632761 \end{array}\right\} \quad \text{“} \qquad \text{“} \quad .000101$$

Thus, while the difference between the numbers is constantly 1, the difference between the logarithms is nearly constant. These differences, 102, 101, and 101, are known as the "tabular differences,"[3] and their almost constant amount corresponds in a very close degree to the difference of unity between the numbers. The logarithms are therefore nearly proportional to their corresponding numbers, and may be assumed to be exactly proportional to them for practical purposes. Consequently, if any one of the numbers be increased by 0.1, its corresponding logarithm will be increased by .1 of the tabular difference between the logarithm of that number and the logarithm of the next higher number. Thus:

log 4290.1 = 3.632467 (or 3.632457 + .1 of 102)
" 4290.2 = 3.632477 (or 3.632457 + .2 of 102)
" 4290.9 = 3.632549 (or 3.632457 + .9 of 102)

This process of finding logarithms of numbers between two numbers in the table is called "interpolation." To lessen the work, in some tables the tabular differences are inserted in a separate column, and at the bottom of the page is sometimes given the proportional part of the last figure. Thus, if the tabular difference is 102, the additions to be made for .1, .2, .3, .4, and so on, are 10, 20, 31, 41, and so on. Had the number whose logarithm was to be found been 42,901 instead of 4,290.1, the mantissa would have been the same, but the characteristic would have been 4 instead of 3.

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[3] In practice the ciphers preceding the difference figures in the mantissas are disregarded to save time and space, but care must be taken in the interpolation process to add the differences in their proper places to the right of the decimal point.

If the number is composed of six figures, as 429,015, and a 5-place table is used, the correction for the last two figures is found by interpolation as indicated above. The correction for the fifth figure is .1 of 102, or 10, and the correction for the sixth figure is .05 of 102, or 5; hence 15 must be added to 3.632457, the logarithm of 4,290, which gives 5.362472 for the logarithm of 429,015.

Finding the Number Corresponding to a Logarithm

Given the logarithm of a number, the number itself may be discovered by the use of a table of logarithms. First, from the characteristic of the logarithm the position of the decimal point is determined, the operation being simply the reverse of that employed in finding the characteristic. Thus, if the characteristic is always the same as the number of places the first significant figure is removed from the unit's place, it follows that in the number corresponding to a given logarithm the number of places the first significant figure is removed from the unit's place will depend upon the characteristic, being to the left or right of the unit's place accordingly as the characteristic is positive or negative.

Now if the mantissa appears in the table, the corresponding number is found immediately. Thus, to find the number whose logarithm is 2.791059, we find, by reference to a table of logarithms, that the corresponding number is 618.1, the position of the decimal point being determined as noted above.

If, however, no mantissa is found in the tables in exact agreement with the mantissa whose number we wish to find, the first four figures of the mantissa are found, and then by the principle of proportional parts additional figures can be added. Thus, to find the number whose logarithm is 1.325220, we turn to the table and find that this mantissa lies between .325105 and .325310. We now proceed as follows:

$$\begin{array}{lrcr} \text{mantissa of log of} & 2115 & = & .325310 \\ \text{" \quad " \quad " \quad "} & \underline{2114} & = & \underline{.325105} \\ \text{differences} & 1 & & 205 \end{array}$$

$$\begin{array}{lrcr} \text{mantissa of log of required number} & & = & .325220 \\ \text{" \quad " \quad " \quad "} & \underline{2114} & = & \underline{.325105} \\ \text{differences} & (?) & & 115 \end{array}$$

By the principle of proportional parts,

$$(?) : 1 :: 115 : 205$$

$$\text{or} \quad (?) = \frac{115}{205} = .5609+$$

the figures which must be annexed to 2,114 to give the number whose logarithm is 1.325220. Thus the required number is 21.145609 +, the decimal point being determined by the characteristic, which is 1. Beyond the first three additional figures obtained by interpolation, their accuracy cannot be depended on, so that the sixth place is the last one to be retained. Instead of using the phrase, "number whose logarithm is 1.32522," the following briefer expression, "$\log^{-1}$ 1.32522," is commonly employed. Thus:

$$\log^{-1} 2.75631 = 570.571$$
$$\log^{-1} .00352 = 1.00814$$

Finding Powers and Roots of Numbers

In the first part of this chapter we have seen the necessity of a convenient method of finding high powers of numbers in making interest computations. Thus, an annuity of $10, at 6 per cent compound interest, amounts in 30 years to:

$$\frac{10(1.06^{30} - 1)}{1.06 - 1}$$

The reduction of this rather complex form necessitates the raising of 1.06 to the 30th power, which is an extremely tedious process by multiplication. Since the multiplication of the logarithm of a number by a given number has the same effect as raising that number to the power indicated by the given number, the following process should be carefully studied:

$$\begin{aligned} \log 1.06 &= .025306 \\ .025306 \times 30 &= .759180 \\ \log^{-1} .759180 &= 5.74354 \end{aligned}$$

which is the 30th power of 1.06.

In the same way that any desired power of a number may be found by multiplying its logarithm by the number representing the desired power and then finding the number in the table corresponding to the logarithm represented by the product, so any desired root of a number may be found by dividing the logarithm of that number by the number indicating the root to be found, and then finding the number in the table whose logarithm is the quotient.

Find the 30th root of 5.74354.

$$\begin{aligned} \log 5.74354 &= .759179 \\ .759179 \div 30 &= .0253059 \\ \log^{-1} .0253059 &= 1.06 \end{aligned}$$

which is the 30th root of 5.74354.

Referring again to the problem in hand, and substituting 5.74354 in:

$$\frac{10(1.06^{30} - 1)}{1.06 - 1}$$

we find its value to be $790.59, the amount of the annuity of $10, at 6 per cent compound interest, for 30 years.

PART II

DEPRECIATION AND THE INCOME TAX

CHAPTER X

WHAT IS INCOME?

How Economists and Courts Define Income

The emergence of the income tax as the most important source of revenue of advanced nations gives rise to the question: What is income and how is it ascertained? Business men and economists distinguish, in a general way, between gross and net income. Nevertheless the numerous details of business involve so many complications that the simplicity which characterizes abstract discussion of the subject disappears when it becomes necessary to apply principles to changing concrete conditions.

The economic conception of income centers about the idea of increase in value beyond cost of production. Thus Weston defines income as an "increase in wealth in addition to that which is already possessed." He says further that it comes in within a definite period of time and gives an enhanced power of satisfying wants during such period.[1] This is a net profits conception of income. Income has been defined by a German writer as "the sum of economic goods or gains accruing to an individual within a given period, which are not required to replace capital and which therefore may be consumed without reducing his wealth." An American economist says that income is the "services rendered by capital and by human beings."[2] Thus employed income is synonymous with profit; but that such is not universally held to be the meaning of the word is shown in the case of *People v. Niagara County Sur-*

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[1] *Principles of Justice in Taxation,* p. 179.

[2] Fairchild, F. R., "Federal Taxation of Income and Profits," *American Economic Review Sup.,* XI, No. 1, p. 149.

veyors.[3] The court said that, although "profit" and "income" are sometimes employed synonymously, strictly speaking income is "that which comes in or is received from any business or investment of capital without reference to the outgoing expenditures," but that profit is the "gain which is made upon any business or investment when both receipts and payments are taken into account."

The court makes an important distinction, although it fails to give a satisfactory interpretation of profit because of its failure to distinguish "receipts and payments" from income and expenditure, the latter being, ordinarily, the only accurate basis of accounting. The court regards an individual's income in the same sense in which we think of the government's income—without any deduction for the expenses of operation.

In *Waring v. City of Savannah* [4] income is contrasted with net income. The distinction is brought out by showing that no property arises from gross income unless, after meeting the expenses of producing it, there remains some net income. The court says that it is a perversion of the term to call that income which is being consumed as fast as it arises—"going on the back, in the stomach, or in carriages and horses, which are taxed, or in travel or frolic." Income is compared by the court to the fruit of a tree, whereas the tree itself is property, and in the same sense income is the fruit derived from capital and from labor. As the fruit of a tree may be permitted to ripen, germinate, and thus produce other trees, so income may be saved and added to existing capital; on the contrary, as fruit may be consumed as fast as it ripens, so, too, may the income from capital and labor be consumed.

We have, then, two conceptions of income, the gross receipts conception and the net profits conception, both of which find support in court decisions. In *Andrew v. Boyd* [5] the court said that the income from an estate is "the profit it will yield, after deducting the charges of management or the rent which may be obtained for the use of it," and added that rent and profit of an estate are expressions equivalent to income or net income. This is a good illustration of the net profit concept of income. Another court has decided that "in the ordinary commercial sense, 'income,' especially when connected with the word 'rent,' may mean clear or net income." [6]

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[3] 4 Hill (N. Y.) 20.

[4] 60 Ga. 93-99.

[5] 5 Mo. (5 Greenleaf) 199-203.

Is Capital Increment Income?

Is the increase in the value of capital assets income? If so, to be taxable, must such increment in value be realized through sale or through some form of conversion equivalent to a sale? This question came before the Supreme Court of the United States in the case of *Gray v. Darlington*,[7] which arose under the income tax law of 1867. This law levied a tax on "gains, profits, and income" of persons as well as of businesses, trades, and professions.[8] Among the profits taxed were those "realized within the year from sales of real estate purchased within the year or within two years previous to the year for which income is estimated."

GRAY V. DARLINGTON.—In its decision in *Gray v. Darlington* the Supreme Court said that the mere fact that property increased in value between time of acquisition and time of sale did not authorize the imposition of a tax upon the amount of the advance. "Mere advance in value in no sense constitutes the gains, profits, or income specified by the statute. It constitutes and can be treated merely as increase of capital." The court said, furthermore, that the construction adopted might as well be applied to increases in capital values extending over very long periods of time, possibly the entire century—a procedure which, in the opinion of the court, Congress did not intend to sanction.

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[6] *Thompson's Appeal*, 100 Pa. 478-81. President Hadley in his *Economics* (p. 5), says: "Capital is constantly being converted into income and income into capital. But capital under all times and conditions is measured as a quantity, while income is more properly measured as a rate. Capital is a static conception independent of time; income is a dynamic conception involving the element of time."

[7] 15 Wall. 63.

[8] Act of Mar. 2, 1867, Ch. 169, sec. 13. Furthermore, these "gains, profits, and income" were "for the year ending the thirty-first day of December next preceding," etc. It was this phraseology which in the case of *Hays v. Gauley Mountain Coal Co.* (224 U. S. 189) the Supreme Court held to mean annual income, as distinguished from the phraseology of the Act of 1909—"the entire net income . . . *received by it . . . during such year*"—which it held to refer to the time of realization rather than to the period of accruement.

The specific question at issue was whether the advance in value of bonds, during four years, over their cost, was, when realized by their sale, income as intended in the law and therefore subject to taxation as profits of the year in which they were sold. The court said:

> The answer which should be given to this question does not, in our judgment, admit of any doubt. The advance in the value of property during a series of years can, in no just sense, be considered the gains, profits, or income of any one particular year of the series, although the entire amount of the advance be at one time turned into money by a sale of the property. The statute looks, with some exceptions, for subjects of taxation only to annual gains, profits, and income.[9]

The court's assertion that "annual gains" were to be regarded as the chief subject of taxation is of significance, because, whereas the income tax of 1864 was specifically levied on "annual gains" the word "annual" was not used in the law of 1867. As pointed out elsewhere, this interpretation of income as being "annual" income has played a large part in the history of income taxation, particularly in England. In general it can be said that it tends to exclude most of the unusual and extraordinary sources of increase of wealth, such as gifts, inheritances, and increases resulting from sale or conversion of capital assets.

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[9] A similar decision was reached by an English court in *California Copper Syndicate v. Haines* (6 Frazer 894): "It is quite a well-settled principle in dealing with questions of assessment of income tax, that where the owner of an ordinary investment chooses to realize it, and obtains a greater price for it than he originally obtained it at, the enhanced price is not profit in the sense of the income tax law. But it is equally well settled that enhanced values obtained from realization or conversion of securities may be so assessable, where what is done is not merely a realization or change of investment, but an act done in what is truly the carrying on, or carrying out, of a business."

Also in *Assets Co. v. Inland Revenue*, 24 R. 578: "So where a person buys a doubtful debt and recovers a larger sum than he paid for it, the gain is not profit in the sense of the income tax law, unless the purchaser is making a trade of buying such debts."

LYNCH v. TURRISH.—In the case of *Lynch v. Turrish* the Supreme Court says that the decision in *Gray v. Darlington* has since been "questioned or modified," and the government's attempt to distinguish the case of *Gray v. Darlington* from one which arose under the Revenue Act of 1913, by insisting on differences in the wording of the two acts, is met by the Supreme Court thus:

> It urges that the Act of 1913 makes the income taxed one "arising or accruing" in the preceding calendar year, while the Act of 1867 makes the income one "derived." Granting that there is a shade of difference between the words, it cannot be granted that Congress made that shade a criterion of intention and committed the construction of its legislation to the disputes of purists. Besides, the contention of the Government does not reach the principle of *Gray v. Darlington* which is that the gradual advance in the value of property during a series of years in no just sense can be ascribed to a particular year, not therefore as "arising or accruing," to meet the challenge of the words, in the last one of the years, as the Government contends, and taxable as income for that year or when turned into cash. Indeed, the case decides that such advance in value is not income at all, but merely increase of capital and not subject to a tax as income.

BREWSTER v. WALSH.—By the sixteenth amendment Congress was given power to "lay and collect taxes on 'incomes.'" There is no reason to suppose that the word "incomes" was here intended in other than its established meaning, and the weight of authority in both the United States and England, at the time of the adoption of the sixteenth amendment, was favorable to the interpretation given in *Gray v. Darlington.* The principle has received exhaustive consideration in cases dealing with the interests of life tenant and remainderman. In these cases it has become customary to regard increments derived from the sale of capital assets held in trust not as income, and consequently going to the life tenant, but as principal which enhances the value of the estate and passes at the proper time into the possession of the remainderman.[10] In *Brewster v. Walsh,*[11] the District Court of the United States, District of Connecticut, referring to this, says that it is difficult to see how "income" can mean something different when applied to funds held in trust than when applied to individuals, and again:

> It seems that income from investments consists—in the case of bonds, of interest; in the case of stocks, of dividends. There is no income from the sale of investments.
>
> The conclusion seems imperative that the word "income" has a well-defined meaning, not only in common speech but also under judicial construction and this meaning does not include the increase in value of capital assets when realized upon a sale.

TOWNE AND MACOMBER CASES.—In *Towne v. Eisner*[12] and in *Eisner v. Macomber,*[13] the United States Supreme Court, following the doctrine enunciated in *Gibbons v. Malon,*[14] in which it was held that a stock dividend is not income but an accretion to capital as between life tenant and remainderman, held, in the *Towne Case,* that a stock dividend is not income under the revenue law of 1913, and, in the

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[10] Among the leading cases sustaining this doctrine are: *Boardman v. Mansfield,* 79 Conn. 634; *Carpenter v. Perkins,* 83 Conn. 11, 20; *Parker v. Johnson,* 37 N. J. Eq. 366, 368; *Outcault v. Appleby,* 36 N. J. Eq. 74, 78; *Matter of Gerry,* 103 N. Y. 445; *Thayer v. Burr,* 201 N. Y. 155, 157, 158; *Graham's Estate,* 198 Pa. St. 216; *Neel's Estate* (No. 2), 207 Pa. St. 446; *Lauman v. Foster,* 157 Iowa 275; *Slocum v. Ames,* 19 R. I. 401; *Jordan v. Jordan,* 192 Mass. 337; *Mercer v. Buchanan,* 132 Fed. 501, 508.

[11] 268 Fed. 207.

[12] 245 U. S. 418, 426.

[13] 252 U. S. 139.

[14] 136 U. S. 549.

Macomber Case, that a stock dividend is not income under the sixteenth amendment. Two points were established in *Eisner v. Macomber,* namely, first, that "enrichment through increase in value of capital investment is not income in any proper meaning of the term," and, secondly, if it requires conversion (i.e., sale or equivalent transaction) of capital before the tax need be paid, the tax is in reality on capital growth, not on income. The court said:[15]

> Yet without selling, the shareholder, unless possessed of other resources, has not the wherewithal to pay an income tax upon the dividend stock. Nothing could more clearly show that to tax a stock dividend is to tax a capital increase, and not income, than this demonstration that in the nature of things it requires conversion of capital in order to pay the tax.

However, the district court in *Brewster v. Walsh* (1920) stated that the same question as was presented in that case had not been before the United States Supreme Court since *Gray v. Darlington,* and it was in pursuance of the precedent established in that case and followed in *Lynch v. Turrish* that the district court held that appreciation in the value of bonds, even when realized by sale, is not taxable income.

If such increase in value is granted to be an increase in capital, and not income, a tax levied upon it is a direct tax, and, under our income tax law, is not apportioned among the several states according to population, and is therefore unconstitutional.[16]

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[15] 252 U. S. 213.

[16] Professor F. R. Fairchild, in a paper read at the annual meeting of the American Economic Association, Dec., 1920, said: "I recognize that there may be a perfectly reasonable feeling that growth of capital ought to be taxed. But this is an entirely separate question from whether growth of capital should be treated as income. The fact that inheritances are not subject to the income tax does not mean that we cannot tax inheritances. If growth of capital assets is a proper subject for taxation, there should be a separate tax for that purpose. Such taxes have already been developed in various countries: for example, Germany's *Zuwachssteuer,* which before the war had made considerable progress. Of course, the fact is that such a tax would undoubtedly be considered a direct tax in this county and would so run counter to the constitutional requirement of apportionment among the states according to population. . . . The proper remedy is a constitutional amendment. . . ." (*American Economic Review Sup.,* XI, No. 1, p. 153.)

GRAY V. DARLINGTON REVERSED.—On March 28, 1921, the United States Supreme Court rendered a unanimous decision in which it reversed its earlier decisions in *Gray v. Darlington,*[17] and asserted that any increase in the value of capital assets, when realized, is income, and as such taxable under the income tax law. The test case involved the estate of Arthur Ryerson who left, as a part of his estate, capital stock in the firm of J. T. Ryerson and Son, valued at $560,000 as of March 1, 1913.

In 1917 this stock was sold for $1,280,000, the cash received becoming a part of the estate. A tax of $311,000 was collected on this increase and suit was brought for its recovery.

In arriving at this definition of income the Supreme Court relied chiefly on certain of its recent decisions, notably *Stratton's Independence v. Howbert,*[18] in which income was defined as "a gain derived from capital, from labor, or from both combined"; *Eisner v. Macomber,*[19] in which income was defined as "a gain derived from capital, from labor, or from both combined, *provided it be understood to include profit gained through sale or conversion of capital assets"*; and in *Hays v. Gauley Mountain Coal Co.,*[20] in which the court drew a very important distinction between the wording of the Act of 1867 and that of 1909—one upon which, according to its decision, turns the question of what really constitutes income under the respective acts. Quoting from the law of 1867 to the effect that "the tax herein provided for shall be assessed, collected, and paid upon the gains, profits and income *for the year*[21] ending the thirty-first of December," etc., and from the law of 1909 to the effect that the income to be taxed is "the entire net income . . . *received by it* . . . *during* such year," the Supreme Court stated that the expression of the law of 1867 refers to the *period of accruement* and therefore requires that the taxable income be the annual income, whereas the expression of the law of 1909 refers to the *period of realization,* and therefore measured the tax by the income received within the year in question, irrespective of the time of its accrual.[22]

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[17] However, see above, p. 197, note 8, for an interpretation based on the exact wording of the Act of 1867.

[18] 231 U. S. 399, 415.

[19] 225 U. S. 189, 207.

[20] 247 U. S. 189.

[21] Italics are the author's.

The court said that it remained entirely satisfied with the definition given in *Eisner v. Macomber* and that "since the fund so taxed was the amount realized from the sale of stock in 1917, less the capital investment as determined by the trustees as of March 1, 1913, it is palpable that it was a 'gain or profit,' 'produced by' or 'derived from' that investment, and that it 'proceeded from' and was 'severed' or 'rendered severable' from it, by the sale for cash, and thereby became that 'realized gain' which has been repeatedly declared to be taxable income within the meaning of the constitutional amendment and the acts of Congress."

The court considered at length the contention that there exists an important difference between an isolated sale of property and the sales made by one engaged in buying and selling as a business, such as a merchant, a broker, or a real estate agent, and that only gains made on sales of the latter kind are income and therefore taxable; in short, that gain resulting from a sale by a broker would be income, whereas if it resulted from a sale made by one holding the same assets as an investment the gain would be a capital increment and therefore not taxable as income. The court maintained that no such distinction between investors and dealers was recognized in the Civil War income tax acts, or in that of 1894; that such a distinction was not recognized under the excise tax law of 1909; that it is not found "in terms" in the revenue laws of 1913, 1916, 1917, or 1918; that the word "income" employed in the sixteenth amendment, as developed by the Supreme Court, does not recognize such a distinction; that such a rule has not been applied in departmental practice during the past seven years; and that there is "no essential difference in the nature of the transaction or in the relation of the profit to the capital involved whether the sale or conversion be a single, isolated transaction or one of many."

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[22] Except that all income accruing prior to the first of Jan., 1909, the date when the law became effective, was not taxable even though received thereafter.

This decision is of far-reaching importance. It makes all increments of wealth income, provided such increments be realized through sale or other form of conversion. It is a step farther away from the concept of income in the sense of annual gains. It destroys the distinction between an owner or investor on the one hand and a trader on the other, so far as the ascertaining of profit at the time of sale is concerned. Presumably the same rule will be made to apply to losses. Whether or not the important differences of definition found in *Gray v. Darlington* and the recent decisions culminating in the *Ryerson Case* can be satisfactorily explained on the ground that the words of the statutes justify such contradictory distinctions is now a question of little more than academic interest, since for practical purposes of taxation the last interpretation given by the Supreme Court will remain effective until new laws necessitating a different interpretation are passed or the Supreme Court reverses its stand.

CHAPTER XI

INCOME CONCEPT EMBODIED IN LEGISLATION—DEPRECIATION

Early Legislation in United States

By Act of August 5, 1861, Congress provided for a 3 per cent tax on the excess over $800 of the "annual income of every person residing in the United States or elsewhere, or from any source whatever."[1] This law never went into effect. In 1862 a tax of 3 per cent was levied on the "annual gains, profits or incomes of any person residing in the United States, whether derived from any kind of property, rents, interest, dividends, salaries or from any profession, trade, employment or vocation carried on in the United States or elsewhere, or from any source whatever," to the extent that the income exceeded $600. If the income exceeded $10,000 the rate was 5 per cent.

These early statutes did not give satisfactory definitions of income. In proceeding from gross income to net income it is necessary to determine what deductions are allowable. The internal revenue officers were instructed to be careful not to allow deductions when they should be regarded rather as expenditures.[2] It was held that no deduction should be allowed for depreciation of stocks or other property unless actually disposed of at a realized loss.[3] Repairs were distinguished from permanent improvements,[4] and increased values resulting from improvements were chargeable to capital, not to revenue. Repairs were regarded as including only such improvements as served merely to prevent property from becoming useless or from lessening in value.[5]

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[1] The sixteenth amendment to the Constitution of the United States provides that, "Congress shall have power to levy and collect taxes on income from whatever source derived, without apportionment among the several states, and without regard to any census or enumeration." This does not limit the meaning of the word "income" in any way and therefore leaves it to Congress and the administrative authorities of the Bureau of Internal Revenue to make such qualifications and limitations in the use of the word as they may think proper.

[2] 3 *I. R. R.*, p. 140.

[3] *Ibid.*, p. 109.

Legislation in the Confederacy

The Confederacy also imposed an income tax. In arriving at taxable income the allowable deductions were provided for in a series of six provisions. In case of incomes from real estate, other than houses, a deduction of not over 10 per cent of gross rentals was allowed to cover annual repairs. In case of incomes derived from manufacturing and mining a deduction from the "gross value of the products of the year" was permissible to cover rent, cost of labor, and raw materials. In case of incomes derived from navigating enterprises deductions were allowed from gross earnings to the extent of "the hire of the boat; if not owned by the person running the same, or if owned by him, a reasonable allowance for the wear and tear of same, not exceeding ten per cent per annum, and also the cost of running the boat or vessel." Cost of labor and "prime cost of materials" were allowable deductions from gross income in shipbuilding enterprises. In case of the sale of property there were deductible the cost of the property sold, including transportation cost, salaries of clerks, and rental of buildings.

Later Legislation in the United States

LAW OF 1894.—The income tax law of 1894, which was intended to go into effect January 1, 1895, was levied on all "gains, profits and incomes derived from any kind of property, rents, interest, dividends, or salaries, or from any profession, trade, employment or vocation." A section of the law was devoted to an explanation of income. The necessary expenses actually incurred in carrying on an occupation were deductible. Likewise a deduction was to be made for interest on indebtedness, losses actually sustained, and worthless debts. The law also levied a tax on the net profits of corporations, the allowable deductions comprising not only ordinary expenses and losses but also interest on indebtedness.[6]

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[4] The law of 1864 permitted as a deduction, "the amount paid out for usual or ordinary repairs, not exceeding the average paid out for such purposes for the preceding five years." (Ch. 173, sec. 117.)

[5] *2 I. R. R.*, p. 61.

The law of 1894 taxed all "personal property acquired by gift or inheritance" during the year. Strictly speaking, inheritance applies only to real estate, which is excluded in the law. In most countries the word "income" is defined as a regular or average return, and for this reason income tax laws levy the tax on an income secured by averaging the returns over a period of years. This procedure is typical of English income tax legislation. Reference has already been made to the case of *Gray v. Darlington,*[7] in which the United States Supreme Court declared that the statute (that of 1867) applied only to income represented by acquisitions made during the year preceding that of assessment and collection and that mere advance in value does not constitute income.

One provision of the law of 1894 was to the effect that profits derived from the sale of real estate were to be considered income only in case the real estate had been purchased within two years previously. Under the law of 1862 such profits were held to be taxable income irrespective of the time of purchase. The law of 1864 made them income only when the real estate had been bought in the same year as sold, but this was placed at two years in 1867. This was a somewhat crude attempt to distinguish between capital profits and trading profits.

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[6] Permitting corporations to deduct interest on indebtedness gives rise to the question of the distinction between income of corporations and income of individuals. In case of an individual, interest on borrowed money should unquestionably be allowed as a deduction in arriving at net income; but in case of a corporation the case is somewhat different. Its earning power is represented by both its stocks and its bonds and for this reason some authorities claim that in determining the net income of corporations for purposes of taxation interest on borrowed capital should not be deducted. The question is one which must be settled on purely practical grounds. At the present time the tendency is to exclude borrowed capital in determining corporate income, i.e., to permit interest on borrowed capital to be deducted in arriving at net taxable income.

[7] See p. 197.

In providing for a tax on successions the law of 1894 taxed something more than income. Inheritances and gifts are not income but transfers of capital, and to the extent that they are taxed as income to that extent does the law fail to conform to the concept which regards income as a regular or average flow of wealth representing increased proprietorship derived from regular or normal business activities.

LAW OF 1913.—The income tax law of 1913[8] includes in net income "gains, profits, and incomes derived from salaries, wages, or compensation for personal services of whatever kind, and in whatever form paid; or from professions, vocations, businesses, trade, commerce, or sales or dealings in property, whether real or personal, growing out of the ownership or use of or interest in real or personal property; also from interest, rents, dividends, securities, or the transaction of any lawful[9] business carried on for gain or profit, or gains or profits and income derived from any source whatever, including the income from, but not the value of, property acquired by gift, bequest, devise, or descent."

Although this does not employ the phrase "annual income," used repeatedly in English legislation and found in early American income tax legislation, it does adopt the concept of income as being a regular periodic return because it specifically excludes windfall accretions to surplus—such as property acquired by gift or inheritance. In the debates on this law in Congress, Senator Cummins said:[10] "I do not think that there is any man in America who would contend that .... a devise or bequest of property . . . is income. I never heard of its being so construed, and it is not possible that it could be so construed."[11]

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[8] The corporation tax law of 1909 was not, strictly speaking, an income tax law, but an excise tax law. The tax, however, was determined by the amount of income, and so fulfilled the function of an income tax. Its administration necessitated a definition of income, and in the case of *Stratton's Independence v. Nowbert* (231 U. S. 399, 415), the United States Supreme Court, interpreting this law, defined income as "a gain derived from capital, from labor, or from both combined."

[9] The word "lawful" is omitted in the 1916 law.

In determining income, it is necessary, as we have seen, to draw the line between income and capital. Here important questions arise in connection with such transactions as the sale or conversion of property and the disposition of dividends paid by life insurance companies. The first American income tax law held as profits any excess of selling price over cost irrespective of the time of acquisition. Owing to the dissatisfaction caused by this provision such profits were, by the law of 1867, included in taxable income only if two years or less intervened between time of acquisition and time of sale. It was the intention of Congress, in framing the 1913 law, that the unearned increment should not be regarded as income but as an accretion to capital.

In case of life insurance companies much that is sooner or later returned to the insured or a beneficiary consists, not of income, but of premiums previously paid, and therefore does not represent income to the insured or beneficiary, but a return of capital. An amendment was finally adopted which provided that life insurance companies should not include in income "such portions of any actual premiums received from any individual policy holder as shall have been paid back or credited to such individual policy holder or treated as an abatement of premium of such individual policy holder within such year."

Probably the most important question arising in connection with the determination of income, from the accountant's point of view, is the ascertaining of the deductions to be made from gross income in order to arrive at net income. In the abstract, it is not difficult to lay down the general rule which must govern most allowable deductions, for these are comprehended in some such inclusive phrase as, "all necessary business expenses," or like expression. Difficulty arises, however, when it becomes necessary to determine what are these specific expenses and how their amount and incidence should be ascertained. The law of 1913 provided for deducting "necessary business expenses, interest on personal indebtedness, losses actually sustained during the year, including worthless debts charged off, and a reasonable allowance for exhaustion, wear and tear of the property arising out of its use in the business (not exceeding in the case of mines 5 per cent of the gross value of the year's output at the mines)." [12] Interest paid by corporations was an allowed deduction on indebtedness not exceeding one-half the sum of the corporation's interest-bearing debt and its paid-up capital stock.[13]

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[10] *Congressional Record*, Aug. 28, 1913, p. 4264.

[11] It was so construed in the law of 1894, however.

LAW OF 1916.—The 1916 law, in defining net income, employed nearly the same words as are found in the 1913 law quoted above, merely changing the phrase, "any lawful business" to "any business"; but whereas the 1913 law exempted acquisitions of property acquired by gift, bequest, devise, or descent, this exemption is not mentioned in the 1916 law, while specific provision is made in the latter for the inclusion in income of stock dividends.

The corporation excise tax law of 1909 levied a tax on the net income "received." The law of 1913 taxed net income "arising or accruing from all sources during the taxable year." This seems to indicate that the accrual basis of determining net income is acceptable but leaves the distinction between a "cash" and an "accrual" basis rather indefinite. The 1916 law employs the word "derived" [section 2 (a)] and the word "received" [section 1 (a)] but in section 8 (g) it is made clear that the accrual basis may be employed. Section 8 (a) provided:

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[12] Seligman, E. R. A., *Income Tax* (2nd Ed.), pp. 683-84.

[13] *Ibid.*, p. 685.

> An individual keeping accounts upon any basis other than that of actual receipts and disbursements, unless such other basis does not clearly reflect his income, may, subject to regulations made by the Commissioner of Internal Revenue, with the approval of the Secretary of the Treasury, make his return upon the basis upon which his accounts are kept, in which case the tax shall be computed upon his income as so returned.

Section 13 (d) made similar provision for corporations.

In accordance with this provision of the law *Treasury Decision* 2433 (January 8, 1917) was issued but did not reflect the full possibilities of an accrual basis of accounting. Thus reserves for actual bad debts and other accruing but unrealized losses were not made permissible deductions. This decision contained the following peculiar provision regarding accruals and reserves:

> If, upon investigation, it shall be found that returns made upon the basis of accruals and reserves, do not reflect the true net income, the corporation so failing in this way to return the true net income, will not thereafter be permitted to make its returns upon any basis other than that of actual receipts and disbursements.

It is difficult to understand how income determined on an accrual basis and by means of proper reservations could be other than correct, or how a purely cash basis could be made to show net income correctly where there is occasion for the employment of the accrual basis. This decision provided further that:

> The reserves contemplated by the foregoing ruling, are those reserves only, which are set up to meet some actual

> liability incurred, the amount necessary to discharge which can not at the time be definitely determined, and do not contemplate reserves to meet losses contingent upon shrinkage in values, losses from bad debts, capital investment, etc., which losses are deductible only when definitely determined as the result of a closed or completed transaction, and are charged off.

In most instances the cash basis of accounting is inadequate to show true net income because elements affecting net income are almost sure to be involved, in the form both of accruing losses and expenses and of accruing profits. The whole theory of depreciation is dependent upon the acceptance of the theory of accruals as the correct basis of accounting procedure. Fortunately, and in spite of its early incorrect attitude on certain forms of accruals, the Treasury Department has gradually revised its policy until at present it allows the deduction of all legitimate accruing expenses.[14]

LAW OF 1918.—The law of 1918 defined net income by first listing the items composing gross income and listing those composing the allowable deductions, gross income less deductions being net income.[15] Gross income was made sufficiently comprehensive to include all possible sources of revenue, while specific items were excluded as not constituting income and consequently were non-taxable. Among these were proceeds of life insurance companies, the value of property acquired by gift or devise, and income from certain tax-exempt securities. In case of non-resident aliens gross income was made to include only gross income derived from sources within the United

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[14] Thus the law of 1918 provided that "debts ascertained to be worthless and charged off within the taxable year," are a proper deduction. The Treasury Department construed this strictly and so disallowed as a deduction an amount which, for a given period, was adequate to meet the losses from bad debts of such period, and which should have been allowed for in the profit and loss account, although the specific debts that would ultimately be found worthless could not yet be determined. The Revenue Act of 1921 makes a specific provision for the deduction of "a reasonable addition to a reserve for bad debts," in the discretion of the Commissioner. (Sec. 214 (A-7), *Reg.* 62, Arts. 151, 155.)

[15] Secs. 212 (a), 232.

States.[16] The definitions of gross income in case of individuals and in case of corporations did not differ in essentials, the definition of gross income for individuals being made to apply to corporations with certain specified exceptions applicable to life insurance companies and mutual marine insurance companies but which are of no interest in so far as general principles are concerned.

To arrive at net income, the following deductions from the amount of gross income as limited by the law, were allowed:

1. All ordinary and necessary expenses *paid or incurred* during the taxable year in carrying on any trade or business, including a reasonable allowance for salaries and rentals.
2. Interest *paid or accrued* within the taxable year on indebtedness incurred in the purchase of certain securities the interest upon which is exempt from taxation under the law.
3. Taxes *paid or accrued* within the taxable year.
4. Losses *sustained* during the taxable year and not compensated for by insurance or otherwise, if incurred in trade or business, or if *incurred* in any transaction entered into for profit, although not connected with his trade or business.
5. Losses *sustained* during the taxable year on property not connected with the trade or business if arising from fires, storms, shipwreck or other casualty, or from theft, when not compensated by insurance or otherwise.
6. Debts *ascertained to be worthless and charged off* within the taxable year.
7. *A reasonable allowance for the exhaustion, wear and tear of property used in the trade or business, including a reasonable allowance for obsolescence.*
8. A reasonable deduction for the *amortization* of the cost of buildings and other facilities constructed, erected, installed, or acquired, on or after April 6, 1917, for the

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[16] Sec. 213 for individuals; sec. 233 for corporations.

production of articles contributing to the war, and for the *amortization* of the cost of vessels constructed or acquired on or after April 6, 1917, for the transportation of articles or men contributing to the prosecution of the war.

9. In case of mines, oil and gas wells, other natural deposits, and timber, *a reasonable allowance for depletion and for depreciation of improvements.*
10. Contributions or gifts made for charitable, religious, scientific, and educational purposes, not in excess of 15 per cent of the taxpayer's net income when computed without the benefit of this deduction.
11. Provision was made for filing claims in abatement based on substantial losses, incident to the year 1918, "resulting from any *material reduction* (not due to temporary fluctuations) *of the value of the inventory* for such taxable year, or from the actual payment after the close of such taxable year of rebates in pursuance of contracts entered into during such year upon sales made during such year." The law further provided that in case no such claim was filed but it could be shown that during the taxable year 1919 a substantial loss of this character had been sustained the amount of such loss could be deducted from the net income for the taxable year 1918, thus necessitating a redetermination of the taxes for that year.

When the time for paying the last instalment of the 1919 taxes (i.e., December 15, 1920) approached, business men found themselves compelled to pay taxes on earnings of a very prosperous year in a period of falling prices and reduced earnings. An attempt was made to have the provision mentioned above extended so that losses due to shrinkage of inventories in 1920 might be deducted from the taxable net income of 1919, thus greatly reducing, in some instances at least, the final instalment due December 15, 1920. An amendment to the law would have been necessary to accomplish this, and none was passed. Owing, however, to the importance of inventories and of inventory valuation in determining net income,[17] the Treasury issued a decision modifying its requirements as to the valuation of inventories.

The above are the provisions of the law which had for their object the determination of legitimate deductions by individuals. Essentially the same provisions governed in case of corporations and it is unnecessary here to mention the variations from the above provisions of the law as it applied to corporations. Certain words have been italicized in order to bring out more clearly the extent to which the law went in its attempt to apply the general principles which underlie the accrual or true basis of accounting as distinguished from a purely cash basis. There are so many forms of income and outgo which occur either before or after the corresponding transfer of cash takes place, or else without any transfer of cash whatever, that true net income can in but few instances be determined by an accounting on a cash basis.[18]

LAW OF 1921.—In general, the law of 1921 marks a continuation of the policy previously developed by the Treasury of applying the accrual basis of accounting. By making a reasonable addition to a reserve for bad debts a deductible item it improved upon the law of 1918.

The Income Concept in British Legislation

We have seen [19] that the United States revenue law of 1861 was levied on "annual income" of "persons." The law of 1894, declared unconstitutional shortly after its passage, omitted the qualifying words "annual" and "persons"; so that in recent legislation in the United States the tendency has been to make the word "income" all-inclusive as well as impersonal in meaning.

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[17] "In order to reflect the net income correctly, inventories at the beginning and end of each year are necessary in every case in which the production, purchase, or sale of merchandise is an income-producing factor." (*Reg.* 62, Art. 1581.)

[18] The adoption of the accrual basis of accounting for determination of net income makes possible a correct application of the principles which govern the application of expense arising from depreciation. Probably there is no better illustration of the separation of cash expenditures from the expenses which ultimately arise from such expenditures; because many years may intervene between construction or installation and abandonment, and some adequate scheme of distributing the expired value over such period is necessary.

[19] P. 205.

In England, on the other hand, income was and is used, with reference to income taxation, in the sense of "annual income," and the English tax is levied on the "annual value" of property and on the "annual profits or gains" of a trade or profession. In England it is customary, in referring to the value of an estate, to speak of its annual or rental value rather than to mention the worth of the property itself. Probably this has given rise to the persistent use of the word "annual" in the British law. At any rate, certain definite concepts attach to the idea of annual income which have great influence in determining how incomes must be taxed in England. Most noteworthy is this, that annual income is thought of in the sense of regular customary income and thus excludes the idea of income in the form of inheritances, chance profits, and so on. It is this same conception of income which causes the British tax to be levied on a three-year or five-year average. The English law makes it easier for the taxpayer by this smoothing-out process; but it evens things up by adopting a general concept of income which is less advantageous to the taxpayer than is that now accepted in the United States. Briefly, the British law interprets income in about the sense as does the average man, i.e., as being money which is received in the ordinary course of business without any very fine-spun distinction as to whether it is a return of capital or true net profit.

English Theory of Income

Consequently the English conception of taxable income does not carry with it the same idea respecting the preservation of investments in wasting assets as is found in the American conception of what is taxable income. The British theory is well shown in the findings of the recent Royal Commission on the Income Tax, which are to the effect that all sources of income depreciate, and that a professional man might claim a deduction for the wasting away of the investment which he made when he secured his education and training with as much justice as a business man might make claim for the wastage resulting from depreciation of his investment in physical assets. The Commission assumed, furthermore, that, on an average, thirty-five years might be taken to be the normal life of any physical asset and that a deduction for depreciation ought not to be permitted unless it could be shown that an asset depreciates more rapidly than this, and then only to the extent that it does depreciate more rapidly. In the words of the Commission, "the principle is that, as all material assets waste, and as no income emerges from a source which is so permanent as not to be subject to the possibility of wastage in capital value, there shall be a time limit to the recognition of wastage."[20] The following example illustrates this theory. A machine costs $10,000 and has a useful life of twenty years. At 3½ per cent interest, $354 set aside every year will create a sinking fund which at the end of twenty years will amount to $10,000, the cost of the machine. That part of the $354 (namely, $150) which would have to be set aside yearly in a sinking fund in order to accumulate to $10,000 in thirty-five years would not be permitted as a deduction in determining taxable income. Consequently the allowance would be $354 — $150, or $204 yearly.

In fact, the concessions which have been made by the British government regarding depreciation allowances have been small when compared with the liberal attitude adopted by our Treasury Department. Before 1878 practically no allowance was permitted. The law granted a deduction for actual expenditures for repairs and renewals, but not in excess of the average expenditures for the preceding three years. Allowance could not be made for existing depreciation unless money had been paid out to cover it. In 1878 the law was modified to permit the deduction of a reasonable amount for the diminished value of machinery and plant resulting from wear and tear. Depreciation was not mentioned in the law and no amount was permitted for obsolescence. Buildings were not specially mentioned in the law.

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[20] This quotation and the illustration following it are found in Professor C. C. Plehn's pamphlet, *British and American Income and American Excess Profits Taxes Compared.*

In 1897 a complaint made to the Chancellor of the Exchequer brought the reply that no objection would be made to a deduction from the assessable profits of the year of so much of the replacement cost as was represented by the existing value of the replaced machinery. This of course allows nothing by way of theoretical or composite depreciation. The Finance Act of 1907 provided that no allowance could be made in excess of an amount which, when added to previous allowances, equals in amount the cost of the plant plus any additional capital expenditures. This grants nothing positive in the way of a depreciation allowance. The Finance Act of 1910 granted some further relief in the way of allowances for maintenance and repair of land and farm buildings. Essentially, therefore, down to the time of the income tax legislation necessitated by the Great War, the English did not alter the position taken in 1878. Before any allowance could be secured for obsolescence the old machine had to be scrapped and a substitute secured. All theoretical or composite depreciation had to be borne by the owner, so far as the income tax was concerned.

British Theory versus Accounting Theory

The reader will have no difficulty in determining wherein the theory underlying the British attitude on the depreciation allowance varies from what is almost universally regarded as good accounting practice. Nor does the fact that the British tax works well detract in any way from the possibility of having an equally workable tax based upon a correct theory of depreciation. That the general administrative machinery back of the British law is better than ours is admitted. It also appears, in general, that the British law favors the preservation and accumulation of invested capital; indeed this fact is emphasized by those who see much that is superior in the British system. That doing so increases taxable income in the long run is also quite evident. Does it not appear, then, that a policy which permits such frugal allowances for depreciation is somewhat contrary to the general and avowed policy followed in England, viz., that of granting protection to invested funds?

If capital is to be sustained and replaced it seems evident that the source of replacement funds must be the gross income derived from the productive employment of that capital; nor does there exist a surplus of value over that employed as capital in productive enterprise until all elements of expense entering into production have been returned to the investment. As long as existing capital is sustained and added to by increments saved from net profit so long does the total fund of capital increase; and as long as this fund increases the foundation of future taxable income is being strengthened. The chief objection urged against the American plan of allowing adequate reserves is the wide latitude allowed to taxpayers in determining their rates of depreciation as well as the presumed fact that when the theory underlying depreciation reserves is fully understood by bookkeepers it will be employed so effectively in reducing taxable net income that the effectiveness of the tax will be greatly reduced. Thus Professor C. C. Plehn writes:

> Of course, the main difficulty in practice is the vagueness and indeterminate character of the computations. This results in one man working on one rule and another on another rule, hence in inequality of the taxes as between the two.

> It is certain that if our British cousins ever come to allow for wasting assets, they will set up a nice little mathematical formula which all must follow.[21]

And again:

> We have, as shown, greatly overdone the allowance for depreciation, depletion, obsolescence and other reserves. If we separate capital from income, and drop the idea of always striving to catch every windfall gain, we can return to common sense in these matters.[22]

The first quotation is in no way a refutation of the correctness of the theory of depreciation reserves as generally understood and as discussed elsewhere in this book. It raises objection rather because of the difficulty of making a practical and just application of the theory. But the impracticability of making the application is greatly overemphasized. In the first place it must be remembered that the income tax is now regarded as a permanent part of our revenue system, and in the second place that the theory as now developed and promulgated by our Bureau of Internal Revenue allows as a total deduction *no more than the cost of the assets in question.* This means that, whether depreciation rates are too high, too low, or just adequate to offset accruing depreciation, the taxpayer can in any case secure a deduction no greater than his investment in depreciating assets. This means that so long as the income tax is a permanent and acknowledged part of the fiscal system the apparent injustices resulting from various and unequal rates of depreciation are leveled up by the passage of time; for if too much is written off early in the life of an asset then less will be permitted later on, while if too little is deducted this will be compensated for by increased rates later on or possibly at the time of replacement. It is true that some injustice might be done if the rates of taxation were made to fluctuate greatly over short periods of time. This, however, is not a refutation of the correctness of the depreciation reserve theory but a reason why the tax rates should be determined according to some really comprehensive plan. At any rate it is doubtful whether changing tax rates would give rise to any greater injustices on this score than are inherent in any system of taxation on various other grounds. The chief thing to be noted is that no more than the cost or fair value of an item as of March 1, 1913, can be deducted. Consequently if too much is deducted at one time less than might otherwise be asked can be deducted at a later time.

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[21] *British and American Income and Excess Profits Taxes Compared,* p. 28.

[22] *Ibid.,* p. 30.

Conclusion

In fact, the English and American systems arrive at somewhat the same result, but by diverse methods. The real point at issue is: Which system is less liable to "kill the goose that lays the golden egg," the one which is theoretically correct or the one which is theoretically incorrect? It is agreed that from certain points of view the British income tax favors the integrity and growth of invested capital, as is shown, for example, in its adoption of a three- or a five-year average of income and its exclusion from taxation of inheritances, increments arising from sale of capital assets, life insurance premiums paid up to 15 per cent of annual income, and so on. But this certainly is not true of the depreciation policy which has been incorporated in it.

The expiration of outlay on depreciating assets is just as much an expense of conducting business as are expenditures for labor, fuel, raw materials, and repairs. The only difference is that in case of labor, repairs, and so on the disbursement of cash occurs at about the same time that the expense is incurred, while in case of expense arising from depreciation of capital assets the disbursement of cash occurs a considerable time, sometimes years, before the expense through depreciation arises. In other words, the expense is paid for in advance because machines, buildings, etc., can be employed to advantage, the loss resulting from the tying up of money in the form of material assets being compensated for by the greater productivity secured by the use of these assets. If we suppose the not unlikely situation of two concerns with equal capitals, A and B, A using most of its capital in constructing the most up-to-date buildings and installing the most efficient machines, while B uses a much greater portion of its capital in hiring a labor force to do the work which A's more efficient equipment renders unnecessary; then if we allow B to deduct its large wages expense in determining taxable net income but fail to allow A to deduct an amount sufficient to return the expired outlay on its plant, we are penalizing A. In general, businesses necessitating the investment of large sums in the form of fixed assets are, under this system, treated less favorably than those which are constantly turning over capital in the form of merchandise, wages, and other so-called current expenses.

Perhaps the contrast is brought out best by comparing a mining company with one engaged in manufacture. The mining company buys raw materials in the form of mineral deposit; the manufacturer buys raw materials in the form of ores which the mining company produces. The mining company is given no deduction for the exhaustion of deposits which it has purchased and which are in reality its raw material, but the manufacturer is permitted to deduct the entire cost of his raw materials as one of his expenses of production. The main point of difference is that the mining company purchases its raw materials *longer in advance,* but this, if anything, is only a better reason why, in determining taxable income, it should be allowed a deduction for the cost of deposits exhausted.

CHAPTER XII

POLICY OF TREASURY DEPARTMENT—DEPRECIATION

Depreciation as Interpreted by Treasury Department

In the two preceding chapters was discussed the development of the general theory underlying the problem of depreciation as illustrated in the income tax legislation of the United States and England. In this and following chapters will be explained in greater detail the established policy of the Treasury Department in regard to depreciation, depletion, obsolescence, and amortization.[1]

The income tax law of 1921 provides that in computing net income, both for individuals and for corporations, there shall be allowed as deductions "a reasonable allowance for the exhaustion, wear and tear of property used in the trade or business." This part of the law refers to depreciation in a restricted sense and does not cover depletion, obsolescence, or amortization, which are cared for in other provisions of the statute. A like distinction is made by the Treasury Department in the regulations which it has established for the purpose of interpreting and applying the statute.

As interpreted by the Treasury Department for income tax purposes the word "depreciation" excludes the idea of a mere reduction in market value due to changing commercial conditions. Moreover, the amount allowable on the grounds of exhaustion, wear and tear, or obsolescence should be determined in accordance with some consistent plan whereby the amounts thus allowed as deductions over the useful life of the property plus any salvage value remaining will be equivalent to its cost, or to its value as at March 1, 1913, if purchased before that date.[2]

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[1] Appendix D contains Bulletin "F," which sets forth the Treasury's policy in detail.

Original Cost as Basis of Depreciation Allowance

The Treasury Department thus definitely adheres to the theory that the depreciation allowance should be just sufficient to afford replacement at original cost of the investment and not at some greater or lesser cost which may have been necessitated by changing prices. This might be termed the "investment theory" of depreciation as distinguished from the "utility theory," which is based on the assumption that the replacement to be provided by depreciation reserves is one which is not of equal cost, necessarily, but one which is of equal utility. During periods such as that from 1910-1920, the enormous variations in prices would create great discrepancies in the amounts which would be reserved, respectively, according to the two methods mentioned above. Although accountants are divided in adherence to these methods it seems that the majority of practitioners as well as theorists adhere to the theory followed by the Treasury.[3] In its classification of operating revenues and operating expenses of steam roads[4] the Interstate Commerce Commission provided that the "depreciation charges shall be based in each instance upon the percentage of the *original cost* (estimated if not known) ledger value or purchase price of the property determined to be equitable. . . ." The Commission thus quite definitely adopted cost as the basis for its depreciation policy, although it allowed some latitude to companies whose peculiar circumstances might make some variation in policy necessary. Moreover, the Commission's directions provide that no further charges shall be made to depreciation "when the difference between the ledger value and the estimated scrap value shall have been credited to the accrued depreciation account."[5]

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[2] *Reg.* 45, Art. 161.

[3] For a discussion of this subject by one favoring the investment theory the reader is referred to Professor J. Hugh Jackson's article, "Some Problems in Depreciation," in the *Journal of Accountancy*, XXXI, pp. 83-86. Professor Jackson points out that if the true cost of product or service is to be secured it must be charged, not with depreciation at a rate sufficient to make replacements at possibly greatly increased costs, but at a rate sufficient to absorb cost of equipment replaced less any salvage that may exist. He says (p. 83): "The fact that the equipment cannot be replaced at the same cost, but only at much more, has nothing to do with the cost of the present product but only with the cost of future product turned out by the subsequent plant. True cost, therefore, can be obtained only by including as the total depreciation charge the loss based on the original cost of the equipment."

[4] *Special Instructions*, sec. 8, effective July 1, 1914.

The Treasury's theory of depreciation is grounded on the fact that most kinds of property approach a point where their usefulness is exhausted; and it is to property of this sort that the allowance is limited. The theory of depreciation does not apply to inventories and to stocks held for trading purposes, nor to land when considered apart from improvements or developments added to it. Neither does it apply to the exhaustion of mineral deposits for which other provision is made.[6] Moreover, for the Treasury's purposes the deduction is properly restricted to property used in the business of the taxpayer and does not apply to expenses in the form of depreciation of his dwelling or of automobiles used chiefly for pleasure.

Repairs and Renewals versus Depreciation

Article 103 of *Regulations* 62 provides:

> The cost of incidental repairs which neither materially add to the value of the property nor appreciably prolong its life, but keep it in an ordinarily efficient operating condi-

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[5] *Reg.* 62, Art. 164, further elaborates the Treasury's attitude as follows: "The capital sum to be replaced by depreciation allowances is the original cost of the property in respect of which the allowance is made, except that in the case of property acquired by the taxpayer prior to March 1, 1913, the capital sum to be replaced is the fair market value of the property as of that date. In the absence of proof to the contrary, it will be assumed that such value as of March 1, 1913, is the cost of the property less depreciation up to that date. To this sum should be added from time to time the cost of improvements, additions and betterments, the cost of which is not deducted as an expense in the taxpayer's return, and from it should be deducted from time to time the amount of any definite loss or damage sustained by the property through casualty, as distinguished from the gradual exhaustion of its utility which is the basis of the depreciation allowance. In the case of the acquisition on or after March 1, 1913, of a combination of depreciable and nondepreciable property for a lump price; as, for example, land and buildings, the capital sum to be replaced is limited to that part of the lump price which represents the value of the depreciable property at the time of such acquisition."

[6] See Chapter XIV.

> tion, may be deducted as expense, provided the plant or property account is not increased by the amount of such expenditures. Repairs in the nature of replacements, to the extent that they arrest deterioration and appreciably prolong the life of the property, should be charged against the depreciation reserve if such account is kept.

Ordinarily when we speak of the useful life of a property we infer that ordinary repairs are to be made and the cost thereof is to be charged direct to profit and loss in the period in which incurred. When this is done repairs constitute an expense additional to depreciation in no way related to the original cost of the property.[7]

If renewals are so extensively made as to constitute a complete return of capital consumed, there is, of course, no need of a depreciation reserve and no deduction on account of depreciation should be claimed. It is the author's contention, however, that those instances in which renewals can be made to compensate for actual accrued depreciation are negligible, and that therefore it is better to set up formal depreciation reserves and charge renewals against the reserves. The reasons for this are explained elsewhere.[8]

Intangible Property

In general, the Treasury permits the writing down of intangibles if they are of limited duration of life, such, for example, as patents, copyrights, licenses, and franchises. When intangibles are not thus definitely limited as to length of life they cannot ordinarily be made the subject of depreciation charges. Yet if it can be shown that it will be of value in the business for a limited time only, and this time can be estimated with reasonable certainty, it may be written off, provided the Commissioner of Internal Revenue is given full information as to the facts. Originally it was not the intention of the Treasury to grant any allowance for depreciation in respect of goodwill, trade-names, trade-marks, trade-brands, and secret formulas or processes, and provision to that effect was included in the regulations issued by the Treasury Department. However, on July 1, 1919, war-time prohibition became effective and brewers sustained heavy losses on goodwill, trade-marks, and trade-brands. As a consequence the regulations were amended to make possible a reasonable allowance for the depreciation of such assets.[9]

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[7] See p. 39.

[8] See Chapter II.

Method of Determining Allowance for Depreciation

Article 165 of *Regulations* 62 provides:

> The capital sum to be replaced should be charged off over the useful life of the property either in equal annual installments or in accordance with any other recognized trade practice, such as an apportionment of the capital sum over units of production. Whatever plan or method of apportionment is adopted must be reasonable and must have due regard to operating conditions during the taxable period.

This gives the taxpayer wide latitude in determining the exact method he will follow in ascertaining his allowance. The best known of the many methods of writing down assets are described elsewhere in this book.[10] The expression "any other recognized trade practice" gives almost unlimited scope to the taxpayer, apparently the only limitation upon it being that his plan must already have met with recognition in the trade. In England the reducing balance method has long been popular and the Inland Revenue, in prescribing rates, has usually expressed them as percentages such as should be used according to that plan. In the United States the so-called straight-line method, which requires that an equal percentage be written off original cost each year, has been most popular; but no plan appears to have received the official sanction of the Treasury Department, probably because it has not attempted to prescribe any rates.[11]

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[9] *T. D.* 2929 (Oct. 7, 1919). See also letter to Mr. Levi Cooke, Washington, D. C., signed by Commissioner Daniel C. Roper, and dated June 21, 1919; also letter to Mr. Levi Cooke, Washington, D. C., signed by Acting Commissioner J. H. Callan, and dated Aug. 19, 1919. These are printed in full in the *Journal of Accountancy,* XXVIII, pp. 299-301.

[10] See Chapters VII and VIII.

Value to be Depreciated

In general, the value to be depreciated is either: (1) the value of the asset as at February 28, 1913, or (2) its cost if acquired subsequent to that date. The former is an arbitrary valuation adopted because it was unconstitutional for Congress to tax income until after the adoption of the sixteenth amendment to the Constitution. As a general rule the value as of March 1, 1913, was the original cost less depreciation as of that date. Yet if there had occurred appreciation previously to March 1, this may be taken into consideration in determining value as of March 1, 1913, for depreciation purposes. Conversely, if value was actually less than cost less depreciation, that value should be used as the base. Ordinarily no revaluation on the basis of such appreciation or depreciation in excess of that written off is made; but sometimes, especially in case of patents, the fair market value as of March 1, 1913, is shown to be much in excess of cost.[12]

By "cost" is meant the amount paid for property plus additional expenditures for betterments and improvements. The amount subject to depreciation may be reduced by losses, damages, or sales. Perhaps the greatest difficulty in determining cost for purposes of depreciation arises when a single purchase is made of a plant which consists of both depreciating and non-depreciating assets, as is the case when land and buildings are purchased. In such instances some plan must be devised of determining the values assignable to the depreciating and non-depreciating assets, respectively.

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[11] See Appendix D.

[12] "Loss as a Factor in the Determination of Income," by George E. Holmes, in *The Federal Income Tax, Columbia University Lectures* (1921), p. 142. An appraisal made as of March 1, 1913, based on reproduction cost as of that date less depreciation from original acquisition, has been declared to be a "fair and reasonable method of determining value . . . as nearly as it is possible now to do." (*Committee on Appeals and Review Memorandum* 272, 40-20-1223.)

When the consideration given in payment is in some other form than cash, as, for instance, when stock or bonds are the consideration, the cost is the fair value of such securities. This is determined by the market value of the securities, if they have a market value; otherwise the fair cash value of the property as at the time of sale must be determined. When property is acquired by gift or devise, bequest, or descent the value as at the time of such transfer is the basis for determining depreciation. It must be borne in mind, however, that the estimated salvage or scrap value must be taken into consideration in determining the annual allowance.

Depreciation and Invested Capital

Some business men have charged off too much for depreciation, others too little. In the one case the invested capital is understated, while in the other it is overstated.[13] To determine true invested capital the depreciation reserve account must be reconstructed and the surplus account accordingly increased or decreased. Only when depreciation allowances have been excessive is any of the depreciation reserve true surplus.

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[13] *Committee on Appeals and Review Memorandum* 106 (18-21-1614) states that: "It is the judgment of the Committee that there is no warrant for reducing earned surplus because of alleged failure to charge off sufficient depreciation in the past, unless the depreciable assets of the corporation are valued on its books at the beginning of the taxable year at an amount in excess of their actual value at that time. This is particularly true where the corporation in prior years earned positive income from which larger deductions for depreciation might have been taken, if in the opinion of the officers and directors of the corporation such larger charges had been justified. Nothing herein is to be construed as precluding the Income Tax Unit from adjusting depreciation, either by way of increase or decrease, where there is at hand affirmative evidence that as at the beginning of a taxable year the amount of depreciation written off in prior years was insufficient or excessive."

The correct attitude of the Bureau and the proper conduct of its field agents, in particular, are plainly set forth in that part of article 839 of Regulations 45, which reads:

"Adjustments in respect of depreciation or depletion in prior years will be made or permitted only upon the basis of affirmative evidence that as at the beginning of the taxable year the amount of depreciation or depletion written off in prior years was insufficient or excessive, as the case may be."

Office Decision 90 (1-19-129) provides that paid-in surplus representing tangible property need not be reduced by reason of depreciation of the property in question. All adjustments necessary on account of inadequate or excessive depreciation should be made in connection with earned surplus or undivided profits.

This matter has become very important, at least temporarily, because invested capital was prescribed by the revenue laws of 1917 and 1918 as the basis upon which the excess profits tax is determined. It would be out of place here to enter into a discussion of the various Treasury rulings which deal with the technicalities of this problem, except in so far as the general principles of accounting are illustrated.[14] The statute of 1918, broadly speaking, permitted the inclusion of four elements in invested capital, namely:

1. Cash paid in for stock.
2. Tangible property paid in for stock (not exceeding its actual cash value at time of payment).
3. Paid-in and earned surplus and undivided profits.
4. Intangible property paid in for stock, within certain limitations.

Neither the regulations nor the law appear to contemplate any diminution of (1), (2), and (4) as the result of depreciation or depletion. In determining them, depreciation and depletion need not be considered. Neither is any increase in these items permitted because of appreciation arising from unearned increment or otherwise.[15] It was to (3) that the Treasury looked when it issued regulations requiring that full recognition be given to depreciation, obsolescence, and depletion from the time of the original organization of the concern down to the taxable year. There is, in fact, no earned surplus until after all such expenses have been properly allowed. In case of companies which had distributed all earnings as dividends and therefore could claim no earned surplus and undivided profits, but which had failed to make proper allowance for depreciation, obsolescence, or inadequacy, it is held that a liquidation or reduction of capital has taken place.

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[14] See the *Journal of Accountancy*, XXVIII, pp. 353-68, for an illuminating article by William B. Gower, entitled "Depreciation and Depletion in Relation to Invested Capital."

[15] The matter of appreciation in relation to invested capital has been passed upon by the United States Supreme Court in *La Belle Iron Works v. The United States* (May 16, 1921). This decision disallowed the inclusion of increased values in earned surplus and therefore in invested capital. This decision lends added authority to the theory that accounting is based on cost and realized values, not on arbitrarily written-up values.

The correct determination of earned surplus really necessitates an analysis of the elements which have affected the surplus account, both charges and credits, from the time of the organization of the enterprise. The regulations require "full recognition" of "all expenses incurred and losses sustained" from the date of inception of the business down to the taxable year. As to the need of inclusion of all expenses incurred there can be no question, but not all accountants agree that all "losses" must be deducted in order to arrive at earned surplus. Certain losses are losses of capital, not profits, and it may properly be asked whether some of these cannot properly be capitalized.[16]

There is, however, one exception to the rule that the invested capital is determined strictly on a cost basis. In case of property acquired before March 1, 1913, its value as of that date may be used for purposes of writing off depreciation, and in such cases, as is recognized in the Treasury regulations, the depreciation reserve is composed of two elements, one a true depreciation reserve element calculated upon the original cost basis and presumably of an amount sufficient, with future increments, to cover cost less salvage at the expiration of the property's useful life, the other, not an expense, but an additional reservation to cover an arbitrary valuation existing on March 1, 1913. When such an element exists in the depreciation reserve it is, for purposes of determining invested capital, to be regarded like excessive reservations for depreciation, i.e., as a part of surplus and therefore to be included in invested capital.[17] William B. Gower says:

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[16] "It may be logical to claim that *all* losses or gains, however caused, should go to profit and loss, and not direct to some other proprietorship account. But such a claim, while logical enough, does not at all conform to accounting practice of any land or clime." (Hatfield, *Modern Accounting*.)

[17] *Reg.* 62, Art. 844.

> The term depreciation is used to cover both elements, but there is a sharp differentiation between the two, for one is an element of true corporate expense, which must be recognized invariably in economic accounts, while the other element is a mere allowance, an artificial product of income-tax legislation, born with the income tax, and assured of oblivion at its demise.[18]

It may also be noted here that whereas, for income tax purposes, the allowance for depletion may be based on a fair valuation, only actual cost for cash or the ascertained value at the time acquired, if purchased for cash, is allowable in determining invested capital.

Errors in Estimating Depreciation

If, as is not unlikely to occur, an error is made in estimating the proper rate to be used owing to the impossibility of forecasting with great accuracy the useful life of an asset, it will be found that, when the property is abandoned or scrapped, the sum written off plus salvage value may not equal original cost. If too little has been written off the difference should be taken as a loss in the year in which the property is scrapped and should be deducted in that year for income tax purposes. If too much has been written off the excess should be reported as income in the year in which the residual value of the property is realized. This is equivalent to the realization of a larger salvage value than was anticipated. If, however, the error has been so large as to indicate negligence or fraud the Commissioner of Internal Revenue may require that the returns for past years be amended and the allowances for depreciation corrected.[19]

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[18] *Journal of Accountancy,* XXVIII, p. 361.

[19] The Bureau of Internal Revenue has ruled that where the books of a company were kept on a cash receipts and disbursements basis an amount received in 1920 as rental from April 6, 1917, to March, 1920, must be treated as income for 1920, and that since there is no authority in the statute for offsetting against income received in one year, losses sustained in a prior year from depreciation, except as provided in secs. 204, 214 (a-12), and 234 (a-14) of the statute, only depreciation sustained in the period covered by the return can be claimed. (*Office Decision* 948, 24-21-1687.)

This is a matter of great importance over a period of years in which tax rates vary extensively, whereas if tax rates remain stationary over long periods it is a matter of relatively small importance. At any time when a taxpayer becomes convinced that his estimates are in error he can alter them, subject to the approval of the Commissioner of Internal Revenue.

When Depreciation Commences

Sometimes construction extends over a considerable period of time before operations begin. It will be satisfactory to the Treasury if depreciation is first deducted in the year in which the property is put into operation and for the period of time extending from the date of the inception of the property's use to the close of the period for which the return is made.[20] Any depreciation which occurs before the property is put into actual use should remain capitalized and thus become a charge to be distributed over the property's useful life.

Adjustment of Depreciation Rates

Since it is impossible to estimate with accuracy the future life of a property, even under favorable circumstances, and since many unforeseen circumstances arise to modify existing estimates, it is proper that revision of these should be permitted when circumstances warrant it. Not only is the taxpayer allowed to take depreciation due to wear and tear into consideration in making his estimate of his property's future useful life but also is permitted "to allow for such future (not past) obsolescence as may be expected from experience to result from the normal progress of the art."[21] Changes in market value should in no way modify the plan followed since these are in no way related to the useful life of the property; moreover changes which affect market values should be considered only in so far as they actually affect the property's estimated useful life.

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[20] "The term 'useful life' as used in article 161, Regulations 45, is interpreted to mean the period of time over which an asset may be used for the purpose for which it was acquired. In the case of a new building, this period starts at the time the building is completed and capable of being used. Buildings under construction are not subject to a depreciation allowance for income tax purposes." (*Office Decision* 845, 11-21-1510.)

[21] *Reg.* 62, Art. 166.

Varying Rates for Same Property

Among the factors which may make it necessary to use different rates for two items of the same physical construction are: climate, repairs, hours of operation, speed, and so on. For this reason it is poor policy to accept published rates blindly and without making due allowance for special circumstances which may invalidate rates which are quite proper when applied under different and perhaps more normal circumstances.

Rates to be Used

Contrary to the practice of the English Inland Revenue, the Treasury Department has found it inadvisable to prescribe any definite rates for specific classes of assets;[22] but it lies within the power of the Commissioner to reject any rate he may think excessive. Probably this is the best arrangement in a country possessing so many variations as to climate and other physical conditions. Care and hours of operation are but two of many other factors entering into the question of rates. Repairs is an influential factor. Intent to defraud will not be presumed, therefore, unless the taxpayer takes a stand which is very clearly unreasonable.

Patents and Copyrights

The amount to be allowed as a deduction for patents and copyrights is its cost or fair market value as at March 1, 1913, if acquired before that date. The Treasury has held that cost of a copyright to the author consists of his actual cash outlay in securing it, including the actual cost of producing the work, but does not include any amount for his time and labor.[23] This amount should be apportioned over the life of the patent or copyright, from the time of its grant, or of its acquisition, or since March 1, 1913, according to circumstances.[24] In case of a patent or copyright acquired from the government its cost consists of fees, cost of drawings, models, and so on which were actually paid. If a patent is purchased with stock, the fair market value of the stock paid determines its value. If a patent becomes obsolete before it expires, the deduction which may be made, with the Commissioner's permission, is such part of the amount subject to a depreciation deduction as is proportional to the remaining years of the patent's life as compared with the period which may intervene between the date of the acquisition of the patent and the date of its legal expiration.

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[22] Rates of depreciation on specific classes of assets are sometimes agreed upon in conference with representatives of the owners, as, for example, steam schooners engaged in the coastwise lumber trade.

In reality the problem of dealing with patents is somewhat more complicated than might be inferred from the above discussion. Patents, considered as assets, are similar to goodwill, in that their value is directly measured by their earning power. In fact, although patents have a definite legal life, their value is frequently more or less permanently capitalized, because wherever possible their value is made permanent through continuous improvements and also because, even when the legal title has passed, the use and control of the article may be so completely monopolized and exploited that competitors cannot successfully take it up. In such case its value becomes quite definitely a part of a concern's goodwill. Deductions based on a normal life of seventeen years are, of course, optional with the taxpayer, and where the value of a patent tends to become a more or less permanent part of capital through the process described above the taxpayer is favored somewhat.[25] The assignment of patents under an agreement giving the assignor 40 per cent interest in the profits therefrom entitles the assignor to deduct 40 per cent of depreciation deductible.[26]

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[23] *Office Decision* 966, 27-21-1721.

[24] *Reg.* 62, Art. 167. For the author's view of obsolescence, see pp. 21-34.

Drawings and Models

The taxpayer is given the option of charging off the cost of drawings, patterns, models, etc., designed to improve facilities or output, against current revenues, or of treating them as assets. In the latter event if their useful lives can be estimated with a reasonable degree of accuracy they may be written down by the usual method of caring for depreciation.[27]

Accounting Procedure

Article 169 of *Regulations* 45 provides:

> A depreciation allowance, in order to constitute an allowable deduction from gross income, must be charged off.[28] The particular manner in which it shall be charged off is not material, except that the amount measuring a reasonable allowance for depreciation must be either deducted directly from the book value of the assets or preferably credited to a depreciation reserve account, which must be reflected in the annual balance sheet. The allowances should be com-

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[25] In determining invested capital for purposes of the excess profits tax corporations which have not written down the value of their patents, but have incorporated it as part of goodwill, may include it in invested capital. Likewise, if such value has been charged against surplus or otherwise disposed of in such a way as not to benefit the corporation in computing its taxable income since January 1, 1909, any amount so written off may be restored in computing invested capital, if the Commissioner is satisfied as to its propriety. (*Reg.* 62, Art. 843.) A deduction in 1917 for 8 patents acquired in 1902, all of which, except one, expired before Jan. 1, 1917, was disallowed however. (*Committee of Appeals and Review Memorandum* 95, 47-20-1312.)

[26] *Committee on Appeals and Review Memorandum* 35, 10-20-779.

[27] *Reg.* 62, Art. 168.

[28] In *Law Opinion* 498, interpreting the revenue law of 1917, the Solicitor of Internal Revenue held that depreciation actually sustained within the tax year "need not be charged off within the year in order to be allowed as a deduction from gross income, but must be charged off before the deduction could be allowed." This was confirmed in *Law Opinion* 547, interpreting the law of 1916, in which the Solicitor held that:

"Whenever a corporation has clearly suffered allowable depreciation which has not been charged off on its books and on reopening its books charges off such depreciation by proper entries, it is entitled to the benefit of the deduction of such depreciation subject to the general provisions of the law." (*Committee on Appeals and Review Memorandum* 377, 5-21-1415.)

> puted and charged off with express reference to specific items, units or groups of property, each item or unit being considered separately or specifically included in a group with others to which the same factors apply. The taxpayer should keep such records as to each item or unit of depreciable property as will permit the ready verification of the factors used in computing the allowance for each year for each item, unit or group.

Under the corporation excise tax law of 1909 the Commissioner required that depreciation, to be an allowable deduction, must be credited directly to the property account affected.[29] This was contrary to the best accounting practice. On May 9, 1912, the use of reserve accounts for the reception of such credits was recognized as correct procedure and since then has had the approval of the Internal Revenue Bureau, although, if the taxpayer prefers he may still follow the procedure of crediting the allowance directly to the property account.[30]

The requirement that the depreciation allowances be computed with "express reference to specific items, units or groups of property" is one which, if adhered to, would do much towards placing the procedure with reference to depreciation on a scientific basis. It is required that each item or unit be considered separately or else "specifically included in a group with others to which the same factors apply." The expression, "the same factors," is undoubtedly intended to refer to the conditions which determine the rate and nature of the depreciation. Many concerns still follow the antiquated procedure of writing off a round sum on the entire cost of depreciating assets, and frequently its amount is made to depend on the current earnings, being increased in prosperous years and decreased in lean years. A properly kept record of plant, such as is described elsewhere,[31] would obviate the use of such haphazard methods.[32]

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[29] *T. D.* 1742.

[30] *Reg. 62*, Art. 169.

Management of the Reserves

No other accounting question has been the subject of greater discussion and misunderstanding than has that of the *use* of depreciation reserves and the corresponding portion of the assets to which they refer. Ordinarily there is no specific fund established to represent these assets but they are permitted to remain a part of the general body of the assets. Nevertheless the Bureau of Internal Revenue, in its earlier rulings, held that the reserves could not be used for any other purpose than making good loss sustained through depreciation,[33] and that "the investment of depreciation reserve funds in the concern's own plant in the way of additions and extensions would appear to be such a diversion." [34] This assertion was based on the theory that such investing of the depreciation funds would indicate that excessive amounts were being set aside to cover depreciation and that a corporation doing this would be adding to the value of its capital assets.

In a letter to Willard H. Lawton, replying to his letter taking issue with this stand, the Bureau of Internal Revenue said that although the investment of the depreciation funds in additions and betterments appeared to be a diversion of such funds to purposes other than making good depreciation already sustained, it may be allowed "if the property account is charged with the amount of the fund thus used, in which case the depreciation account remains a liability and renewals and replacements when made are charged against it rather than against current income." As there is nothing in this condition which is not strictly in accordance with good accounting procedure this may be regarded as a reversal of the Bureau's stand on the matter.

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[31] See Chapter VI.

[32] See Appendix D.

[33] *Reg.* 33, Art. 132.

[34] *T. D.* 2137.

On April 10, 1917, the Bureau ruled [35] that the reserves need not be held intact or remain idle until needed to replace the specific assets for which the reservations were made, or until needed to restore capital invested in depleted assets. Furthermore, providing the reserves are not excessive and are properly entered on the books so as to constitute a liability against their respective complementary assets, the conversion of such reserves into tangible assets would not be regarded as constituting a diversion of funds such as would make the deduction for depreciation an improper one.[36]

Diversion of Reserves

Depreciation reserves are set up to avoid overstatements of profits. They do not form a part of surplus except in so far as they are excessive. For this reason dividend payments are not properly chargeable against them, and should not in any case be so charged as long as there exists any distributable surplus. In 1917 [37] the Bureau held that a dividend so charged would be regarded not as a distribution of profits but as a distribution of capital and therefore not subject to tax in the hands of the taxpayer. Dividends ought not to be charged against depreciation reserves in any case, however, because if there is a surplus it should be charged, while if there is no surplus such a dividend payment is equivalent to a reduction of capital and should be regarded as such rather than as a distribution of reserves. In October, 1917, accordingly, the Bureau revoked the ruling made in the preceding July, in the following manner: [38]

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[35] *T. D.* 2481.

[36] For the correspondence leading up to this decision see Montgomery, *Income Tax Procedure,* 1918, pp. 365-66. See also Appendix D.

[37] Letter to Henry W. Beal, signed by Deputy Commissioner L. F. Speer, dated July 14, 1917.

[38] *T. D.* 2540 (Oct. 10, 1917).

> All such dividends received by stockholders declared out of such reserves accumulated subsequent to March 1, 1913, constitute income to the stockholder under the act of September 8, 1916, and must be accounted for in returns of net income.

The present attitude of the Treasury regarding the distribution of reserves may be summarized briefly.[39] Depreciation reserves are not surplus and therefore ordinary dividends cannot be paid from them. If dividends are so paid they are to be regarded as liquidating dividends and are taxable as income to the recipient only to the extent that the amount so paid is in excess of the cost or fair market value of his shares of stock as of March 1, 1913. Before such a distribution from a depletion or depreciation reserve will be deemed to have been made the surplus and undivided profits must first have been exhausted. When dividends are paid out of such reserves the stockholders must be notified that such dividends are a return of capital and not a distribution of profits.

A somewhat different problem arises when a corporation proceeds to distribute its so-called net income among its stockholders without having first made provision for depreciation. Under the earlier regulations such corporation was estopped from any deduction on account of such depreciation unless conclusively shown that the property account had been reduced by the amount claimed for depreciation, or unless it had been credited to a depreciation reserve account and was shown to be of reasonable amount.

This has been modified to the extent that a corporation which has thus paid dividends without first having set up depreciation reserves may reopen its books in order to make the proper reservations. It must then file an amended return for the period in question. This privilege is not granted if the preparation of the original return was fraudulent or grossly negligent.[40] When the proper adjustment is made and the reserve set up the corporation is in the position of having paid dividends out of its depreciation reserves to the extent that it has exceeded its actual net income. The stockholders have received dividends consisting partly of a distribution of capital; so they should make amended returns showing the amount received from profits and that received from capital, i. e., from the depreciation reserve, so that their tax can be adjusted accordingly.

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[39] *Reg.* 62, Art. 1546.

Discontinued Property

The use of property may be discontinued for sundry reasons. If this is done but no sale or other disposition of the property is made, the taxpayer should nevertheless make a determination of the loss or gain resulting from such abandonment.[41] The loss or gain must be disclosed in the taxpayer's return for the year in which such loss or gain is ascertained and a full disclosure of the facts relative thereto made. If such discontinued property is sold or otherwise disposed of, the amount realized thereon should be compared with the estimated salvage value employed in determining the loss or gain as explained above. The difference is to be considered as loss or gain of the year in which the sale or disposition of the property is made.

To illustrate, assume that Company A permanently discontinues the use of a building which cost $25,000 and against which there exists an offsetting depreciation reserve of $15,000. It is estimated that the salvage value of the building is $5,000, although it is not sold or otherwise disposed of. Under these circumstances Company A should return a loss of $5,000 along with all available data substantiating that figure, and such loss should be deducted in the return for the year in which its determination is made. If, during the next fiscal year, the building is disposed of for $6,000, this amount, compared with the estimated salvage value, $5,000, indicates a gain of $1,000, which should be returned as taxable income in the year in which such sale is made.

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[40] *Bulletin "F,"* pp. 33-34, printed in Appendix D. Also, the book value of the assets must be reduced by an amount equal to the difference between the amount of depreciation actually sustained and charged off and the amount of earnings and surplus available for depreciation at the end of the taxable period. Invested capital is correspondingly reduced. (*Committee on Appeals and Review Memorandum* 112, 10-21-1497.)

[41] *Reg.* 62, Art. 170.

Depreciation of Farm Property

Farmers meet with a variety of depreciation problems. They are permitted a proper allowance on all buildings except the dwelling house which they occupy. Farm machinery and other physical property, such as livestock purchased for draft, dairy, or breeding purposes, is subject to a suitable depreciation allowance. No allowance is permissible, however, on livestock raised or purchased for resale. Cost and estimated life are the principal factors to be taken into consideration in determining livestock depreciation.[42]

Farmers may, if they wish, determine their net income by the inventory method.[43] This requires that an inventory be taken at the close of each year, and that gross income be determined by adding to sales the gain or deducting therefrom the loss for the year due to increase or decrease in the value of the inventory. This method may be illustrated as follows:

Sales of livestock and farm products for year		$9,000
Inventory of livestock and products, beginning of year	$3,000	
Cost of livestock bought during year	2,000	
	$5,000	
Deduct inventory of livestock and products, end of year	4,000	
Deduct decrease in inventory value at end of year as compared with inventory at beginning of year		1,000
Gross income for year		$8,000

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[42] *Reg.* 62, Art. 171.

[43] *Income Tax Primer for Farmers*, p. 90.

If the inventory method is not used, all gains, profits, and income derived from the sale of products should be included in income whether such products are produced on the farm or are purchased.[44] Sometimes farmers find it desirable to sell property originally purchased for use instead of for resale, such, for example, as farm machinery and draft horses. In such cases the amount to be reported as income is the excess of the sale price over cost reduced by any sums previously deducted for depreciation. If the sale price is less than cost less depreciation previously deducted, the difference is to be reported as a loss.

One who operates a farm for profit is entitled to deduct all amounts "actually expended" as necessary expenses in carrying on such business. He may consider the cost of ordinary tools of short life or small cost as expenses to be deducted directly, but the cost of machinery and farm buildings should be considered as a capital investment and charged off over the period of their useful lives by means of formal allowances for depreciation. The amounts expended in developing farms, orchards, and ranches up to the time when they become productive should be capitalized. Usually such capitalized sums will admit of depreciation allowances from the time when their productivity commences, because orchards deteriorate as do likewise physical improvements of most kinds.[45] The purchase of work animals and livestock, whether for resale or otherwise, is to be regarded as an investment, not as an expense, which will be either amortized by adequate depreciation allowances or removed through resale. Automobiles purchased exclusively for farm business are an investment subject to adequate depreciation allowances. Repairs and upkeep on them are deductible as expenses but when they are so deducted the depreciation allowance should not be larger than is sufficient to cover wear and tear not made good through such repairs and upkeep. If an automobile is used partly for farm business and partly for pleasure only such depreciation cost and cost of repairs and upkeep are deductible as are attributable to farm business. The remainder is a personal expense and as such is not an allowable deduction.[46]

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[44] *Reg.* 62, Art. 38.

[45] For rates of depreciation consult Appendix E on specific assets.

When farmers hold products for more favorable markets no deduction is permissible on account of shrinkage in weight or value or because of physical deterioration.[47] Neither is the total loss of a prospective crop or of one not yet sold a deductible loss. If a farmer is engaged in raising and selling livestock he is not permitted to make any deduction for the value of those which perish. If, however, livestock has been purchased for any purpose and afterwards dies or is killed by order of the authorities of a state or the United States, the actual purchase price reduced by any depreciation previously allowed thereon and also any insurance received, is a deductible expense. The same general rule applies to other property destroyed by order of state or United States authorities. When, however, the inventory method is followed in determining gross income no deductions can be made for livestock or products lost, since such losses are reflected in the inventory at the year's end.[48]

Removal of Buildings and Equipment

When old buildings are removed or destroyed and when old machinery is scrapped in order to make replacement possible, such sum may be deducted as a loss as is represented by the difference between the cost of the scrapped property and "the amount of depreciation sustained with respect to the property prior to its demolition or scrapping, and allowable as a deduction in computing net income." [49] If, however, a taxpayer purchases real estate and demolishes a building standing thereon in order to make place for a new building, he is not permitted to make any deduction on account of the razed building or for the cost incurred in demolishing it, the presumption being that the land, exclusive of the value of the old building, is equal to the purchase price of the property plus the cost of removal of the old building.[50]

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[46] *Reg.* 62, Art. 110.

[47] *Reg.* 62, Art. 145.

[48] *Ibid.*

[49] *Reg.* 62, Art. 142.

Sudden Obsolescence, Etc.

Various emergencies may cause the sudden termination of the usefulness of capital assets. Thus machinery may become obsolete as the result of new inventions. An increase in the cost of or change in the method of manufacture may make it necessary to abandon it altogether, in which case machinery specially constructed to facilitate its processes may be abandoned. Legislation sometimes directly or indirectly makes impossible the continued profitable use of property. Such cases of loss are not supposed to be cared for by the ordinary process of allowing for depreciation. Under these circumstances the taxpayer may claim as a loss in the year in which he discontinues the use of such assets "the difference between the cost, or, if acquired prior to March 1, 1913, fair market price or value as of that date of any assets so discarded (less any depreciation sustained and allowable as a deduction in computing net income) and its salvage value remaining." [51]

Securities and Stocks

Fluctuations in the market value of stocks and bonds give no occasion for deductions from gross income on account of the shrinkage in value of such securities. Such loss can be claimed only in case it results from the actual disposition of the securities. Losses and gains resulting from the sale of securities above or below cost or above or below their market value as at March 1, 1913, give rise to the question, what is income, and are increments and decrements in the value of capital assets, when realized through sale, to be regarded as taxable income or as deductions from taxable income, as the case may be?

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[50] *Ibid.* Losses resulting from removal of buildings, from sudden obsolescence, shrinkage in securities and stocks, etc., do not come strictly under the head of depreciation, and receive separate consideration in the 1921 statute. See sec. 214 (a-4, 5, 6).

[51] *Reg.* 62, Art. 143.

Lessors and Lessees

Depreciation is ordinarily borne by the lessor. Where a leasehold is acquired for business purposes at a specified sum the lessee is permitted to deduct as a business expense each year an aliquot part of such sum. When a lessee erects buildings or makes other permanent improvements on leased ground he is permitted to deduct from gross income as expense an amount equal to the quotient secured by dividing the cost of such improvement by the number of years remaining of the term of the lease, this allowance being in lieu of a depreciation allowance. When, however, the remaining term of the lease is longer than the estimated life of the improvements the deduction should take the form of a depreciation allowance based on the life of the improvement.[52] When the life of an improvement is less than the term of the lease no income need be accounted for by the lessor, either at the time title passes or later.[53]

By the terms of a lease a lessee company was required to return the leased properties to the lessor company, at the end of the lease, in the same condition as at the date of the lease. The lessee company owned all of the stock of the lessor company. It was held that since the leased properties were to be returned to the lessor company at the end of the lease in the same condition as at the date of lease there can be no depreciation of the properties while in the possession of the lessee and therefore no allowance for depreciation can be granted. Allowance may be had for repairs and upkeep cost incurred by the lessee, however.[54]

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[52] *Reg.* 62, Art. 109.

[53] *Mimeograph Letter* 2714, 8-21-1474.

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[54] *Office Decision* 1014, 35-21-1794.

CHAPTER XIII

POLICY OF TREASURY DEPARTMENT—OBSOLESCENCE, INADEQUACY, AND AMORTIZATION

Obsolescence

Obsolescence[1] has not been adequately discussed, either from the general accounting point of view or from the more specialized point of view of income taxation. Until the passage of the revenue law of 1918 no deduction for obsolescence was specifically recognized by law; that law, however, provided for "a reasonable allowance for obsolescence" in addition to that for exhaustion, wear and tear. According to provisions of earlier laws it was necessary actually to dispose of the property before the loss due to obsolescence could be deducted for the purpose of arriving at taxable income. This has been termed "realized obsolescence."

Treasury regulations issued in interpretation of the 1921 law provide that "inasmuch as under the provisions of the income tax acts in effect prior to the Revenue Act of 1918 deductions for obsolescence of property were not allowed except as a loss for the year in which the property was sold or permanently abandoned a taxpayer may for 1918 and subsequent years revise the estimate of the useful life of any property so as to allow for such future (not past) obsolescence as may be expected from experience to result from the normal progress of the art."[2] The regulations further provide that the proper allowance to be made for exhaustion, wear and tear, and obsolescence is such as will (by a consistent plan, but not necessarily at a uniform rate), during the useful life of the property, with the salvage value, and having due regard for expenditures for current upkeep, replace the original cost of the property, or its value as of March 1, 1913, if the taxpayer acquired it before that date.[3] The regulations still further provide that:

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[1] See Appendix D.

[2] *Reg.* 62, Art. 166.

> When, through some change in business conditions, the usefulness in the business of some or all of the capital assets is suddenly terminated, so that the taxpayer discontinues the business or discards such assets permanently from use in such business, he may claim as a loss for the year in which he takes such action the difference between the cost, or, if acquired prior to March 1, 1913, the fair market price or value as of that date of any asset so discarded (less any depreciation sustained and allowable as a deduction in computing net income) and its salvage value remaining. This exception to the rule requiring a sale or other disposition of property in order to establish a loss requires proof of *some unforeseen cause by reason of which the property has been prematurely discarded,* as, for example, where an increase in the cost of or other change in the manufacture of any product makes it necessary to abandon such manufacture, to which special machinery is exclusively devoted, or where new legislation directly or indirectly makes the continued profitable use of the property impossible.[4]

This regulation is issued as an interpretation of that section of the law which provides for the deduction of "losses sustained during the taxable year and not compensated for by insurance or otherwise, if incurred in trade or business."

No mention is made in the law of the subject of inadequacy and it is not emphasized in the regulations and rulings.

Ordinary versus Extraordinary Obsolescence

We conclude from the foregoing that obsolescence should be regarded as either ordinary or extraordinary; that ordinary obsolescence is such as may be reasonably expected to transpire as the result of normal progress in the arts and sciences, and can therefore be calculated with a fair degree of accuracy; but that extraordinary obsolescence, which arises from unforeseeable events, such as adverse or prohibitive legislation or revolutionary changes in methods of production, cannot be calculated in advance of its occurrence. Consequently adequate allowance can be made for ordinary obsolescence by making due adjustments in the estimated useful life of property, but such procedure is inadequate to forestall the effects of events which may work a complete reformation in plans and methods of production.

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[3] *Reg.* 62, Art. 161.

[4] *Reg.* 62, Art. 143.

Present Status of Obsolescence Question

These regulations and the above interpretation of the theory upon which they are based may be said to represent the present status of the obsolescence question, which is admittedly unsatisfactory. The vagueness which characterizes the situation has arisen from a failure to make the proper differentiation between true depreciation and obsolescence, in the attempt to distinguish sharply between ordinary and extraordinary obsolescence, and in the failure to distinguish between obsolescence and inadequacy. The following considerations will make this clear.

1. There is in reality no strict line of demarcation between so-called ordinary obsolescence and so-called extraordinary obsolescence. The difference between them, where distinguishable, is one of degree rather than one of kind. A new invention may make an old machine worthless or it may only reduce its value a certain amount.

2. Obsolescence and inadequacy result from different causes. Obsolescence occurs because of the possibility of securing an equally efficient asset at less cost than, or a more efficient asset at a cost equal to, the book value less depreciation of the old asset. This is sometimes called obsolescence "by super-

session." In reality, such obsolescence may exist a long time before actual supersession becomes desirable or profitable. The useful life of a machine is not shortened when it is made semi-obsolete by new inventions. To make it desirable to scrap it it must first be made wholly obsolete, due allowance being made for salvage value. Inadequacy, on the other hand, results from failure of a property to meet growing demands made upon it. So far as its structure is concerned an inadequate property may be strictly up to date.

3. The method adopted by the Treasury fails to ascribe the loss or expense arising from obsolescence and inadequacy to the proper period. These are costs of progress to be borne, not by the period which sees the use of the old property, but by the period which can afford to pay for the unextinguished usefulness of the old property and still afford a new property with which to displace the old. Obsolescence is an element in the cost of replacement and must be added to the cost of the more efficient property, just as the purchase price and cost of removal of old buildings is added to the cost of a new one built on their site. It is the capitalized cost of progress and should be borne by the period during which the property which displaces the old is being used. The expense resulting from the discontinuance of property possessing use value is with propriety chargeable to the period which can afford to scrap it.

4. The practical effects of obsolescence and inadequacy are ignored. Unless the useful life of a property is shortened there is no problem so far as accounting is concerned. Many partially obsolete properties continue in use to the end of their natural lives just as if no more efficient types had been contrived. This is because cost of abandonment of the old property (measured by cost less depreciation) plus cost of new property results in a higher cost of production than does the continuance of the old property. This cost of abandonment is frequently neglected by business men, or is regarded as a cost

to be charged against the preceding period, or against the period in which the replacement is made, with the result that the profitableness of the new property is overemphasized.

The only cost additional to that arising from ordinary depreciation must result from the shortening of the useful life of the property. Theoretically this remaining life is either reduced at a stroke to zero, as when the cost of production figured on the cost of the new property plus cost of abandonment (depreciated value) is less than cost of production if the old property is continued in operation, or it does not take effect at all because a consideration of the relative advantages of continuing the old property or of replacing it makes it desirable to continue the old property.

Practice Regarding Obsolescence

In practice, of course, no such clear-cut distinction is made. Sometimes entirely obsolete property is continued in use when a saving could be made by immediately superseding it. At other times property only partially obsolete is displaced. Both procedures are wrong. The tendency is to displace property not entirely obsolete, owing to the failure to take into consideration cost of abandonment in addition to the cost of the new installation, as if in some way the remaining use value of the abandoned property could be shifted aside without the incurrence of a loss for it.

When Obsolescence Is Effective

Merely because a new machine can be secured which is more efficient than an old one being used is not justification for replacing the old one. All factors entering into the cost of a unit of output must first be considered for the old machine as compared with the same for the new machine. An invention either makes an old machine obsolete or it does not because at the time of ascertaining whether or not a machine is obsolete its entire future producing capacity is considered along with that of the improved machine. If it is not made obsolete its useful life is in no way affected and unless some further improvement does make it obsolete it will live out its natural life, i.e., the one it runs even if no improvement is made. The question of obsolescence will not arise as a practical problem in connection with it. Ordinary depreciation will be the only expense arising from the expiration of its usefulness.[5]

A Question of Value

Obsolescence should either end the usefulness of a property the instant a new one of a more efficient type can be secured, or it should have no effect whatever, either from an accounting or an operating point of view. Its effect is equivalent to cutting the toe off just below the ear, or else it is nil. In this respect practice should approximate, if it cannnot exactly follow, theory. Income tax procedure should be founded on correct theory. The practice of writing off an amount for obsolescence additional to that for depreciation cannot be justified on theoretical grounds. Obsolescence either prevents all future usefulness of a given property from being realized or it does not affect it at all. It does not "shorten" a property's useful life except when it stops it altogether. This is because it is a question of value and not of physical wear and tear. The question of whether or not it is profitable to displace a property involves the consideration of the whole future use value of the old property less its estimated salvage value. This must be sacrificed entirely or not at all.

A Capital Cost

This plan removes the question of the proper treatment of obsolescence from the realm of vagueness to that of certainty.

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[5] Much accounting literature, including the Treasury regulations, infer that both depreciation and obsolescence may be operative at the same time. This is impossible, since one or the other is greater, and the greater can be the only effective cost.

It draws a definite line of distinction between depreciation from wear and tear and obsolescence based on the nature of these phenomena. No allowance for obsolescence should be made except when an abandonment occurs before the useful life of the property abandoned has expired and such abandoned property is not replaced. In this case it should be regarded as a capital loss, not as an operating expense.

Depreciation is an operating expense because it arises from the necessary and unavoidable *use* of property *in the business.* Obsolescence is not an operating expense because it represents, not the use of property in the business, but its withdrawal *from further use.* If it is not replaced it is a loss to be charged directly against surplus; if it is replaced it is a cost of replacement and should be capitalized.

A type of property becomes valueless for one of three reasons. It can no longer be used because demand for its output has disappeared, or else its work can be done either by another more improved type of property, or by a more adequate property so much more efficiently that its remaining value can be added to the cost of the new property and still enable production to be carried on at a lower total cost per unit of output. In the first case a dead loss results and should be charged to surplus. In the two latter cases the remaining value of the old property should be capitalized and written off over the useful life of the property which supersedes it.

Reserves for Obsolescence

Reserves should not be set up to cover obsolescence, unless it is definitely understood that they are reserves of surplus, not valuation reserves. If obsolescence is effective and replacement occurs the loss is capitalized and no reserve is needed. If there is no replacement, surplus should be charged. The procedure to be followed in case of effective obsolescence is analogous to that now prescribed by the Treasury when property is voluntarily destroyed, viz., the loss is not deductible but is required to be included in the capital investment of the new building, etc., constructed to replace it. It has been said that "a building used for manufacturing may become useful only as a warehouse. If this can be definitely shown to the satisfaction of the Commissioner, an allowance for obsolescence would be permissible, in addition to an allowance for depreciation. The useful life of the building may not be diminished, but the character of its use may be changed and thereby a substantial part of its value may be lost." [6] But the reduction in value does not reduce its original cost which is the basis for depreciation charges, and the building is used as a warehouse because it is cheaper to do that than to tear it down and construct a building intended definitely for warehouse purposes. It is not as cheap, however, as a new warehouse would be were it not necessary to consider the unexpired cost of the old building. The use to which a building may be put may alter the *value* of the building for selling purposes but it does not alter the *cost* of the building for purposes of depreciation and it therefore in no way affects the depreciation charge unless it changes the length of the building's useful life. It is profitable to use a more expensive building because it is not profitable to add its remaining value to the cost of a less expensive one.

AN ILLUSTRATION.—To illustrate the foregoing, suppose that the depreciated book value of an old machine is $2,000 and that its yearly cost of operation is $400; also that a new machine which will perform the same total future service as the old one can be purchased for $4,400 and can be operated at a cost of $200 per annum. If money is worth 6 per cent, the capitalized cost of operation of the old machine is $400 ÷ .06, or $6,666.67; and for the new machine $200 ÷ .06, or

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[6] Holmes, G. E., in *The Federal Income Tax, Columbia University Lectures* (1921), p. 152.

$3,333.33. Adding these to the depreciated value and cost of the old and new machines, respectively, we have, for the old machine:

Depreciated value	$2,000.00
Capitalized operating cost	6,666.67
Total capitalized cost	$8,666.67

and for the new machine:

Cost	$4,400.00
Capitalized operating cost	3,333.33
Total capitalized cost	$7,733.33

The value (for selling purposes) of the old machine has therefore been reduced through obsolescence ($8,666.67 — $7,733.33, or $933.34) to ($2,000 — $933.34) $1,066.66, because $7,733.33 is the highest capitalized cost necessary to do the required work. But the old machine should not be scrapped because cost of production would be more expensive with the cost of the new one added to the book value of the old one. Neither should the $933.34 be written off as obsolescence; it should remain capitalized and be charged off over the remaining life of the machine, which is in no way shortened because it is partially obsolete. Depreciation remains the only effective charge and its amount is not changed or affected because a new machine has been invented.

Suppose, however, that the new machine can be bought for $1,000. Then its total capitalized cost is $1,000 + $3,333.33 (capitalized cost of operating), or $4,333.33. $8,666.67 — $4,333.33 = $4,333.34; so that the old machine has a negative value of $4,333.34 — $2,000, or $2,333.34. Its value, $2,000, can be added to that of the new ($2,000 + $1,000), giving $3,000, which added to $3,333.33 (capitalized cost of operating) gives $6,333.33 as the total capitalized cost of operating the new machine, with the depreciated book value of the old machine included. This is $2,333.34 less than the capitalized cost of operating the old machine. Replacement becomes desirable when the value of the old machine is reduced to a negative quantity; then only does obsolescence become effective.

Treasury Interpretations

The attempt of the Treasury Department to interpret the provision of the law permitting a reasonable allowance for obsolescence may be illustrated by the following cases.

VINEYARDS.—Prohibition legislation has in some instances caused vineyards to be abandoned; in other instances they are continued under cultivation in the hope that some profitable outlet for the crop may be found. In the former case the loss directly resulting may be deducted, but from such loss must be excluded the value of improvements, such as drainage and fencing, which are of use for other purposes. The allowance for such obsolescence must be distributed over the period elapsing between the time of passage of the prohibition measure and the date of abandonment. In exceptional cases, moreover, where the loss is so great that the land becomes practically worthless the taxpayer is also granted a reasonable deduction for obsolescence of land, and this may include the value of improvements which when made were regarded as permanent. The amount to be deducted is the value as of March 1, 1913, or cost if acquired on or after that date, less salvage or junk value, taking into account any previous allowances for obsolescence. If the vineyards are continued under cultivation a reasonable deduction for obsolescence is permitted. This has been tentatively placed at one-half the loss which would result from total abandonment of the property for vineyard purposes.[7]

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[7] *Solicitor's Law Opinion* 862, 8-19-320.

BUILDINGS.—In case of buildings which *may* become obsolete after five or ten years no allowance is permitted; but from the time that it becomes certain that the building will become obsolete at a definite future date, a deduction therefor may be made. The amount thus allowable for obsolescence should be the difference between fair market value as of March 1, 1913, or cost acquired on or after that date, less depreciation already taken and estimated salvage value. This should be spread over the period from the date when obsolescence is determined with certainty until the time when the building becomes obsolete.[8]

The first illustration, that of the vineyards, represents the correct treatment of obsolescence when there is actual abandonment of vines, etc.; but it is incorrect in so far as it permits obsolescence to be deducted for assets which are continued in use for some other purpose, as, for example, is likely to be the case with the land. If land is not abandoned, it is because it can be used profitably, and because it is cheaper to use it than to abandon it and buy cheaper land elsewhere. Land, in fact, never becomes obsolete except from altered favorableness of location which makes it impossible to use it in any profitable enterprise. Unless complete abandonment is made the test of obsolescence it will be necessary to grant obsolescence deductions in every instance where altered conditions have made land, buildings, and other property less valuable than they formerly were.

The second illustration, that of buildings, illustrates well the muddled status of the obsolescence question. We have shown elsewhere [9] that obsolescence is wholly a question of value, that it does not accrue from year to year as does loss from physical wear and tear, and that it either causes abandonment, which may or may not be followed by replacement, or is wholly ineffectual. It is absurd to say that a building will become obsolete at a definite future date. It either becomes obsolete at the instant that a more improved type is contrived or it is in no way affected by obsolescence. In case of inadequacy the situation is different and it is possible to forecast the time when it will become effective with a degree of certainty. In either case, however, the amount not covered by past depreciation allowances based on natural life should be capitalized, or, if replacement be not made, regarded as a capital loss in the year in which abandonment occurs.

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[8] *Office Decision* 381, 4-20-704.

[9] See pp. 21-34.

The inconsistency of the Treasury's stand is shown in its ruling to the effect that no obsolescence can be allowed for goodwill if it will be valuable (but not necessarily as valuable as formerly) in another business.[10]

Complete termination of usefulness is the sole criterion of obsolescence. Where, as in case of mines, the useful life of buildings and equipment is limited to the period required to exhaust the ores, the depreciation allowance should be based on the "useful life" instead of the natural life of such assets.[11]

INTANGIBLE PROPERTY.—The Treasury has departed from its earlier prescribed policy not to allow for the depreciation or obsolescence of intangible property. It has, however, definitely refused a deduction for skill and ability of a professional kind acquired through study, experimentation, and training, on the ground that expenditures necessary to secure such skill are more or less common to all men, also because it is impossible to differentiate between genius and acquired ability.[12] The allowance for obsolescence of intangibles in case of breweries has given rise to the interesting question of the distribution of obsolescence among years. "In the great majority of cases," says the Advisory Tax Board, "depreciation is fairly measured by the effluxion of time." But the situation brought on by liquor legislation is "highly exceptional." [13]

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[10] *Office Decision* 472, 17-20-884.

[11] The Acts of 1913 and 1917 were construed to allow a deduction for obsoleteness only upon the junking or abandonment of property. Obsolescence, interpreted as the "gradual becoming out of use" was not recognized prior to the Act of 1918. The former method is correct in so far as the determination of obsoleteness is concerned, but wrong in permitting it as a deduction when replacement occurs.

[12] *Advisory Tax Board Memorandum* 39, 7-19-291. The allowance is strictly limited to intangible assets which are assignable.

The facts are as follows:

1. On November 21, 1918, the Agricultural Appropriation Act, providing for war-time prohibition, was enacted.

2. On July 1, 1919, prohibition under the above act became effective.

3. In an office letter the Bureau of Internal Revenue held that the obsolescence might be spread over the period from November 21, 1918, to June 30, 1919.

4. One party appealed to the Commissioner, claiming that the above letter erred in limiting the period over which obsolescence might be spread from November 1, 1918, to June 30, 1919, asserting that the "depletion by obsolescence is the result of the Federal prohibition process, which has been in the course of development . . . ," and that although "the trade made substantial apparent profits in 1918" this really resulted from the liquidation of inventories, and that the "trade was garnering apparent profits which in reality were only the salvaging of capital. . . ."

5. This party urged that December 18, 1917, "the date of the action of the House of Representatives which constituted the final submission of national prohibition to the states, be taken as the point of commencement of the obsolescence."

6. Considering the general grounds upon which an allowance should be made for obsolescence of intangibles, the Advisory Tax Board said:

> . . . In the accounting required for tax purposes intangibles, such as good will, trade-marks, and the like are distinguished from tangible property in that in the ordinary case a taxpayer is not required or permitted to make current

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[13] *Advisory Tax Board Recommendation* 44, 15-19-445.

> deductions for depreciation, including in this term ordinary obsolescence. This distinction rests upon the ground that in the ordinary case depreciation of intangibles is too indefinite and uncertain to be reduced to terms of money. In specific instances, however, intangibles may be brought within the rule applicable to tangible property, but only by the force of unusual and controlling circumstances. Article 163 of Regulations 45, for instance, states that "Intangibles, the use of which in the trade or business is definitely limited in duration, may be the subject of a depreciation allowance." It is true that this same article states that no such allowance may be made in the case of intangibles of the class now under consideration, and while in general this negative decision is sound, the controlling rule is the one quoted above, and when an item of intangible property falls within that rule it must be dealt with accordingly.

And again:

> The question next arises whether an intangible acquired at a date when its useful life is indefinite may become the subject of a depreciation allowance at some subsequent date at which time the duration of its useful life becomes definitely known. If so, the loss which might be claimed at the end of the life may be spread over the term of the remaining useful life. . . . The reasonable conclusion seems to be, therefore, that when it is demonstrated that the useful life of an intangible is definitely limited, such intangible then becomes a proper subject of depreciation allowance.

Also:

> Applying these considerations to the intangibles belonging to distillers and dealers in liquors it is found that such intangibles are subject to depreciation (or obsolescence) during the period in which it is known that their useful life is definitely limited in duration. The determination of this period is, however, by no means easy. Looking backward it can now be seen that prohibition has during recent years had a rapid growth in this country, particularly in the South and in the West. Before the constitutional amendment was

> adopted some 33 States had prohibition legislation and local option was similarly effective in substantial parts of many of the other States. As early as March, 1913, the Webb-Kenyon Act gave strong indication of a growing sentiment, and this sentiment has since been registered in many other political and judicial expressions.

7. These preliminary events were regarded as being not sufficiently explicit and final to fix a period at which the property would become valueless. Not even the submission by Congress of the eighteenth amendment on December 18, 1917, was sufficient to do that. Had not great progress been made towards the adoption of the eighteenth amendment before November 21, 1918, the date of the adoption of the war-time Prohibition Act, that date would have been the proper one to regard as marking the commencement of obsolescence. But before that the outcome of the voting on the eighteenth amendment was certain, merely awaiting the convening of the state legislatures. Considering all facts the Advisory Tax Board concluded that an "unprejudiced observer" would have concluded in January, 1918, that prohibition was a future certainty, and so advised that January 31, 1918, was the date at which obsolescence began, while January 16, 1920, when prohibition by amendment became effective, should be regarded as the date of its expiration.

8. The amount which the distillers and liquor dealers could claim as a deduction was the cost of intangibles, or their value if acquired before March 1, 1913, excluding any intangibles acquired since that date the expenditures for which were deductible for tax purposes.

9. On January 31, 1918, the value of intangibles was reduced to the then present value of the income to be derived therefrom between that date and, approximately, January, 1920; and this would probably be much less than the value of intangibles on March 1, 1913.

10. The conclusion of the Advisory Tax Board was that in this case obsolescence of intangibles could not be computed on the time rule; neither could relative profits of two or more periods be used as a basis. "The rule of apportionment which most closely approximates the actual facts," says the Advisory Tax Board, "and is therefore the most reasonable, is that under which the value of the intangibles on January 31, 1918, is spread on the time basis between that date and the date upon which prohibition became effective and the balance of the allowable deduction (measured by the difference between the value on January 31, 1918, and March 1, 1913), taken in accordance with the provisions of section 205 of the act and articles 1621-1625 of Regulations 45 against the first taxable year ending on or after January 31, 1918."

The opinion of the Advisory Tax Board is, in general, well reasoned, but confuses obsolescence and depreciation and shows very plainly that it makes no distinction between them. It speaks of the "obsolescence of intangibles" at one point and of the "depreciation of intangibles" at another point in the opinion without indicating any distinction between these terms. "Depreciation" should be definitely limited in application to allowances based on natural physical life of properties. "Obsolescence" should be applied to all cases where natural physical life is interrupted before wear and tear has run its course and where this is not due to a failure of the properties to perform their function properly. "Inadequacy" should be applied where natural physical life is interrupted before wear and tear has run its course but where this is due to a failure of the properties to perform their function properly. The measure of obsolescence and inadequacy is, ordinarily, cost less depreciation already allowed plus salvage value. Clearly, losses resulting from the diminishing value of intangibles fall under the head of obsolescence, but it is an obsolescence different in character from that which necessitates the scrapping of physical property before it is worn out. It may or may not be accompanied by obsolescence of physical values, depending on whether or not the physical properties can be continued in profitable use. It is a loss entirely apart from any changes which may occur in the value of physical property, and while it may affect physical values it does not necessarily do so, because physical assets may be employed in other lines where intangible assets, such as goodwill, built up for special forms of trade, would be valueless.

Amortization—Provision of 1918 Law

Provision for amortization of plant and equipment "constructed, erected, installed or acquired, on or after April 6, 1917, for the production of articles contributing to the prosecution of the present war" and of "vessels constructed or acquired on or after such date for the transportation of articles or men contributing to the prosecution of the present war" was first made in the revenue law of 1918 and has been reenacted in the law of 1921. This is a provision made to meet conditions peculiar to the war. Many concerns, from patriotic motives, entered upon the construction of new plant or the extension of old plant in order better to supply the needs of the army and navy in the successful prosecution of the war. Such work was necessarily undertaken under conditions highly unfavorable to economical construction. To high costs of labor and materials was added the premium necessarily paid to secure the required progress.

The statute is so worded as to bring within its provisions practically every industry engaged in work of essential importance in carrying on the war, whether as direct or indirect contributors to that end. Probably none but the most non-essential producers are excluded. In reality the restrictions placed upon unnecessary construction by the War Industries Board made it impossible for any but essential industries to engage in construction of new plant and facilities, so that practically all new construction begun after April 6, 1917, is of the kind recognized by the law as contributing to the prosecution of the war.[14]

Purpose of Amortization Allowance

With the details of the administration of this temporary measure we are not concerned.[15] We are, however, concerned with its purpose and theory. In general, it was a recognition of the extra burden which plant construction and equipment in war-time incurs. This same situation was quite fully recognized in the contracts, especially the cost-plus contracts, arranged by the government with manufacturers of war supplies. In discussing this provision of the bill Senator Simmons made it clear that its purpose was to make allowance for the difference in values as represented by war-time costs of production and as represented by postwar conditions. Some equipment was of special construction and consequently worthless except as scrap after the occasion of its usefulness had passed. Other structures might continue useful but under circumstances which would render it unprofitable to construct them at anything like war-time costs of construction.

The Problem Stated

Difficulties are certain to arise in following out the Treasury regulations regarding the method to follow in computing the amortization allowance. For this purpose two bases are recognized:

1. In case of property which has been sold or discarded, or which will be sold or discarded before March 3, 1924, the amortization allowance is the difference between original cost, if acquired on or after April 6, 1917, less deductions made for depreciation and other losses prior to January 1, 1918, and the amount realized at the time such property is sold, or the esti-

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[14] See *Reg.* 62, Art. 183, for the limitations set upon the allowance.

[15] For these the reader should consult the income tax manuals. See, for example, Montgomery, R. H., *Income Tax Procedure,* 1921, pp. 907-22.

mated fair market value as at the date it is discarded plus a reasonable allowance for depreciation in case the property is used in the taxpayer's business after the close of the amortization period.

2. In case of property not included in (1) above, the amortization allowance is the difference between original cost as stated in (1) and the value of the property to the taxpayer in terms of its "actual use or employment in his going business, such value to be not less than the sale or salvage value of the property and not greater than the estimated cost of replacement under normal postwar conditions less depreciation and depletion."[16]

Amortization presents a problem different in some respects from obsolescence. It marks the disappearance not only of value for selling purposes but also all or a large part of the usefulness of property which has been constructed for special purposes. That much war plant was so constructed, and under conditions which were very unfavorable to economical construction, was clearly understood when such construction was undertaken. It was a cost of war, not of progress, and should be regarded as a capital loss. That portion of cost of war plant which cannot be made to produce a fair return under normal postwar conditions is properly regarded as an amount to be written off against war-time output. Contracts for war supplies recognized this fact, so that where specific contracts existed between manufacturers and the government such excesses of investment made in plant for the fulfilment of these special contracts were properly charged against the cost of the output required by the contracts to be manufactured.

In most cases manufacturers who were engaged in essential war industry were not operating directly under government contracts, however. These were permitted to amortize plant specially constructed for war purposes as they saw fit, so far as including such amortized values in cost of product was concerned.

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[16] *Reg.* 62, Art. 184.

The Amount to be Allowed

Four years does not now appear to have been a sufficiently long period in which to determine valuations on the basis of normal postwar conditions, since normal postwar conditions are not yet here (June, 1922).[17] Thus limited as to time the taxpayer is limited as to amount of the deduction only by the requirement that it shall be a "reasonable deduction," the interpretation of which, of course, rests with the Commissioner of Internal Revenue. In calculating the deduction the taxpayer may take into consideration such factors as interest on the investment between time of its withdrawal from use and its sale, improvements which may have been made on the property since the end of the war in order to secure a buyer for it,[18] and so on. If the property is not used at all after the war, the total unextinguished investment less scrap value is deductible. If the taxpayer can use the property in his own postwar business, the difference between cost less any allowance already made and its war value to its owner would be an allowable deduction. If full use is made of the property in such normal postwar activities the deduction allowable should be measured by the difference in the cost of construction and what such cost would have been under postwar conditions.

Property of Postwar Value

The Treasury's handling of the question of deductions in case of property other than that which is not useful after the war period or is certain to be permanently discarded before the last instalment of the tax covered by the return is due, i.e., for property of permanent postwar usefulness, has not been satisfactory. First, the estimated reproduction cost as of April, 1919, of the property in its condition as at that time was made the basis. Necessary adjustments were to be made later, under "normal postwar conditions," without reference to conditions in April, 1919.[19] This was later amended [20] so that the basis of amortization of this class of property was made the "estimated value of the property to the taxpayer in terms of its actual use or employment in his going business, such value in no case to be less than the sale or salvage value of the property, provided, however, that in no case shall the preliminary estimate (for purposes of returns to be made in 1919) of the amount of such amortization exceed 25 per cent of the cost of the property." Further provision was made for readjustments later on the basis of "stable postwar conditions." Later a ruling was issued which explained that the 25 per cent was a tentative amount and that if it is found that a taxpayer is entitled to more than that allowance the 5 per cent penalty and 1 per cent interest should attach only to that amount which upon final settlement is found was owing to the government but was not paid at the time of filing return "by reason of the taxpayer ignoring the regulations." [21]

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[17] The British rule is to assume that postwar values approximate pre-war values, allow the deduction on that basis, and later alter the deduction if necessary.

[18] Holmes, G. E., in *Columbia Income Tax Lectures* (1921), p. 156.

It is difficult to see why any fixed percentage should have been set when all returns are subject to later revision. Twenty-five per cent is a purely arbitrary amount, and if 50 per cent is taken instead, and this later proves to be conservative, no penalty can be levied on the taxpayer.

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[19] *Reg.* 45, Art. 184.

[20] *T. D.* 2859 (approved June 10, 1919).

[21] See Montgomery, R. H., *Income Tax Procedure*, 1921, p. 921. *Reg.* 62, Art. 184, provides that the Commissioner shall "in respect of basic material and labor costs determine and publish ratios of estimated postwar costs of replacement, and a taxpayer shall use such ratios in computing a claim for a tentative allowance for amortization." This is subject to redetermination on or before Mar. 3, 1924.

CHAPTER XIV

POLICY OF TREASURY DEPARTMENT—DEPLETION

Depletion and the Statute of 1909

Until war taxes were levied sufficiently heavy to bring to the attention of taxpayers the necessity of giving closer attention to the question of depletion charges and of invested capital, the principles governing those matters were neither extensively discussed nor consistently followed in practice. This was due partly to the indefiniteness which necessarily attaches to the problem and partly to the natural inertia of business men in their relationship to subjects of little more than academic interest when constantly faced by problems of greater practical importance.

As a rule, before the enactment of our income tax laws, no allowance was made for depletion. The corporation excise law of 1909[1] required that corporations, in determining net income, should make a deduction for "all losses actually sustained within the year," among these being included a reasonable allowance for depreciation of property.[2] But few corporations made any allowance for the depletion of natural resources, under this provision. The Nipissing Mines Company claimed a deduction for depletion at the rate of 31.1 cents per ton of ore mined during the year in question. The Treasury disallowed the deduction and the case came before the United States District Court for the Southern District of New York. In rendering the decision of the court Justice Lacombe said in part:

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[1] C. 6, 36 Stat. 11.

[2] This has been interpreted by the Supreme Court as not permitting an allowance for depletion. *Von Baumbach, Collector v. Sargent Land Co.,* 242 U. S. 503 (decided Jan. 15, 1917). The Bureau of Internal Revenue has accordingly reassessed corporations which claimed a deduction for depletion under the 1909 law.

> If the known value of an ore bed were exactly $2,000,000 and exactly $500,000 were taken out of it each year, in four years there would be nothing left. It is difficult to say why it may not reasonably be said that the ore bed suffers each year a depreciation of $500,000, just as a $10,000 piece of machinery with a life of ten years, suffers a depreciation of $1,000 each year. As I read the statute congress intended to allow all reasonable depreciations to be deducted from the gross profits to find the net; and the reasonableness of any deduction asked for depends upon the nature of the claim on which it is based, not upon the amount of dollars it may aggregate. Nor is it apparent why it should make any difference that one cannot tell with reasonable certainty the total value of the deposit so long as the value of the amount removed in any one year can be ascertained with sufficient accuracy. Nor is it apparent why the problem is altered in any way by the circumstance that the property was bought at a very high or at a very low price, or that the capitalization of the company which owns it is large or small.

In consequence of this decision the Treasury issued a ruling recognizing depletion as a proper deduction in arriving at income, but regarding the intrinsic value as of January 1, 1909, as the amount to be depleted in case of properties acquired before that date. This ruling was not enforced.

Another case which came under the law of 1909 and which involved the question of depletion was that of *Stratton's Independence, Ltd. v. Howbert.*[3] Suit was brought to recover money paid under protest for taxes assessed and levied for the years 1909 and 1910. The point at issue was, what deductions should the corporation be permitted to make from gross income in order to arrive at taxable net income? No question was raised as to the appropriateness of deducting ordinary expenses of operation. Disagreement arose over the amount to be allowed for depreciation of capital due to ore extraction. The trial was based on an agreed statement of facts, to wit: that for the year 1909 the gross sales amounted to $284,682.85; that the cost of extracting, mining, and marketing amounted to $190,939.42; and that the value of the ores so extracted in 1909 was $93,743.43 when still in place in the mine. In other words, the difference between gross sales and cost of extraction exactly equaled the value of the ores before extraction. The facts for 1910 were similar.

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[3] 231 U. S. 399 (decided Dec. 1, 1913).

In its decision the Supreme Court, affirming the decision of the lower court, permitted a reasonable deduction for exhaustion of ores on the basis of their value in the ground, but refused to adopt a definition of value of ore in place, which the company contended for, which would have excluded all profit; explaining that it is fallacious to assume that the ores possessed any such value before they were mined, and that property is to be valued not on latent or occult values, but on practical considerations affecting market value. No depletion was charged on the mine's books, but the court did not express an opinion as to whether or not this was a matter of material importance.[4] The company contended that the entire value of the ores, as ultimately developed, existed from the beginning. The court said:

> We have no difficulty, therefore, in concluding that the proceeds of ores mined by a corporation from its own premises are to be taken as a part of the gross income of such corporation. Congress no doubt contemplated that such corporations, amongst others, were doing business with a wasting capital, and for such wastage they made due provision in declaring that from the gross income there should be deducted (*inter alia*) "all losses actually sustained within the year," including "a reasonable allowance for depreciation of property, if any," etc.

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[4] In *Forty Fort Coal Co. v. Kirkendall, Collector* (233 Fed. 704), it was held that the coal company was entitled to a deduction for depletion, although the amount has been incorporated in surplus instead of being carried to a depletion reserve. In general, depletion deductions do not depend on book entries; nevertheless it should be very carefully seen to that they are properly made. *T. D.* 3102 (issued Dec. 29, 1920) specifically requires that depletion accounts be kept, and that the allowance be credited either to asset accounts depleted or to depletion reserve accounts.

As to the contention made that mining companies are not "doing business" but are merely engaged in converting their capital assets from one form into another the court had the following to say:

> It is clear that a definition of the "value of the ore in place" has been intentionally adopted that excludes all allowance of profit upon the process of mining, and attributes the entire profit upon the mining operations to the mine itself. In short, the parties propose to estimate the depreciation of a mining property attributable to extraction of ores according to principles that would be applicable if the ores had been removed by a trespasser.

Although depreciation and depletion were not carefully distinguished either in the law or in this decision interpreting the law, the meaning is clear. One limitation was definitely placed upon the value assignable to natural deposits for depletion purposes. This principle was embodied in *Treasury Decision* 2446, which provided that the value contemplated as the basis for depletion deductions should not be based upon the assumed salable value of the output, less cost of production, since such a valuation "would comprehend the earning capacity of the plant."

The Law of 1913

The decision in *Stratton's Independence, Ltd.*, was rendered shortly after the passage of the income tax law of 1913. This was the first law which contained definite provision for an allowance for depletion of natural deposits in order to determine net taxable income, namely: "In case of mines a reasonable allowance for depletion of ores and all other natural deposits, not to exceed 5 per cent of the gross value at the mine of the output for the year for which the computation is made."

The 5 per cent limitation was a purely arbitrary one and frequently made it impossible to secure a "reasonable" allowance.[5] The concession, limited as it was, seems to have resulted from the pressure exerted from the mining industry and from the reasoning of the decision of Justice Lacombe in the *Nipissing Mines Company Case.* Nothing was said in the law on the very important question as to what was the proper basis for determining the total value to be written off for depletion purposes; whether, for example, it should be: (1) the original actual investment made to purchase the minerals, (2) the appraised value as at some fixed date, or (3) the intrinsic value of the natural deposits, whether known or unknown. These exclude the one other possibility of a valuation based on the ultimate realizable value of the deposits, which was considered and rejected in the *Stratton's Independence, Ltd., Case.* The Treasury ruled that the original capital investment must be the measure of the amount allowable as deductions for depletion.

The Law of 1916

This law specifically provided that the depletion allowances should not exceed "the market value in the mine of the product thereof which has been mined and sold during the year for which the return and computation are made," but the total thus allowable was not to exceed the original investment or, if the purchase of the deposit was made before March 1, 1913, the fair market value as of that date. This law introduces the complicated question of mine valuation which has since remained one of the serious problems in income taxation. A general discussion of this is found in a later section of this chapter.

The Law of 1918

The 1918 law provided for a "reasonable allowance for depletion . . . according to the peculiar conditions in each case, based upon cost including cost of development not otherwise deducted." In case of properties acquired before March 1, 1913, the fair market value as of that date is the basis for depletion. Further provision, however, is made for the discovery of natural resources on or after March 1, 1913, where the fair market value is "materially disproportionate to the cost," in which case the depletion allowance is based on the fair market value as at the date of the discovery,[6] or within thirty days after discovery.

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[5] The Supreme Court held this limitation constitutional in *Stanton v. Baltic Mining Co.,* 240 U. S. 103 (decided Feb. 21, 1916).

Theory of Depletion

The provisions of the 1916 and 1918 laws represent an attempt to apply the theory of depletion for the purpose of determining just income taxation. In order to ascertain to what extent this attempt has been successful requires the consideration of certain aspects of the problem of value as it applies to the depletion of natural resources.

Is value for purposes of depletion—

1. The original actual investment?
2. The appraised value as at some fixed date?
3. The intrinsic value of the deposit whether known or latent and subject to future discovery and valuation?

BASES FOR DEPLETION.—The 1918 law introduces two bases for depletion allowances. It makes cost the basis for depletion charges in all cases where natural deposits are acquired after March 1, 1913, with the further proviso that where the taxpayer discovers deposits which are not acquired "as the result of purchase of a proven tract or lease" and where the fair market value of such property is materially disproportionate to its cost, the depletion allowance shall be based on a fair valuation made within specified limits as to time. Cost as a basis for depletion is therefore applicable only to proven tracts or leases acquired after March 1, 1913, and to discoveries where cost and fair market value at the time of discovery or within thirty days thereafter are not materially disproportionate. In other cases the basis is the "fair market value" as at some given time—March 1, 1913, in case of properties acquired before that date, and as at the date of discovery or within thirty days thereafter, in case of deposits discovered on or after March 1, 1913, and which have a "fair market value" materially disproportionate to their cost.

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[6] It has been ruled that a discovery cannot be made of any "probable" or "prospective" ores which have been or could have been included in a previous valuation; neither does an improvement in process which gives value to ores which were formerly commercially valueless constitute a discovery. (*Committee on Appeals and Review Memorandum* 124, 19-21-1620.)

These being the circumstances, it may be asked whether, in arriving at a fair depletion basis, cost should be considered at all. Mining engineers have called attention to the great discrepancy which usually exists between the values of operating mines and other similar industries which exploit natural resources.[7] Cost should be used in all cases as the basis or it should be rejected entirely as such a base. To maintain that it should sometimes be employed, as is now required, is equivalent to saying that there are two correct bases instead of one and that it is a matter of chance as to which shall be employed.

Again, why should the date of discovery, in all cases where the discovery is made after March 1, 1913, be permitted to have a preponderating influence in determining value for depletion purposes? Would it not be more equitable to require all valuations of natural deposits to be made as of March 1, 1913, since cost is not the determining element in their value? This would place all natural resources upon an equal footing. If this is not a feasible plan then all concerns should be permitted to make revaluations as of later dates than March 1, 1913, or as of dates later than the date of discovery (or within thirty days thereafter), in order that they may be placed upon a basis of equality with those who happened to make their discoveries when market conditions were more favorable. The other alternative is a cost basis for depletion purposes. Current market fluctuations are not permitted to influence depreciation rates and they ought not to influence depletion rates.

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[7] Norris, R. V., *Columbia Income Tax Lectures* (1921) p. 223.

The deposits discovered since March 1, 1913, were in existence on that date and represented latent values. Of two equally valuable deposits one may have been known on March 1, 1913, the other unknown. Nevertheless the unknown deposit possessed the same potential value at that time. Should the date of discovery of the deposit which was unknown on March 1, 1913, have any influence on the amount of depletion to be deducted, unless there is at that time an actual transfer of the property? The element of inequality which the present method has introduced can only be removed by making the depletion base—

1. Cost, or
2. Value as of March 1, 1913, on the basis of "proven" values, this to apply to all deposits whether known or unknown on March 1, 1913, or
3. Periodic revaluations of all properties.

COST AS BASE.—To use cost as a basis would in many cases give rise to inequalities as between companies and might make the allowance too small in general.[8] To permit periodic revaluations of all properties would cause endless occasion for adjustments and give rise to the question whether or not an increased valuation would create taxable income to the extent of the increase. Value as of March 1, 1913, determined by assuming that deposits discovered since that date were known or "proved" as of that date and therefore comparable with other similar properties, would be equitable, if to such value there were added carrying costs represented by interest on the actual investment in the property from time of acquisition to time of discovery, and if actual transfers for sums in excess of the March 1, 1913, value may be permitted to determine the depletion base wherever such actual transfers have occurred. Any realization of value through actual sales, in excess of the March 1, 1913, value would of course be returned as income.

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[8] The consideration for the deed of a large area of anthracite lands owned by the Lehigh Coal and Navigation Company, made over a century ago, was an "ear of corn."

It should be noted that, whereas the yearly allowance for depreciation is usually based definitely upon the length of the property's useful life, so that each year receives a share about equal to that received by other years during which the property is being used, a different rule is followed for depletion. The Treasury's procedure is analogous to that of a manufacturing plant which buys and consumes iron ore. The depletion allowance is charged to the various years in proportion to the amount of the natural product consumed as compared with the total amount estimated to have existed before depletion began.

FAIR MARKET VALUE AS BASE.—The revenue law of 1918 provided that in case of natural resources acquired before March 1, 1913, the fair market value[9] as of that date, and in case of discoveries made after February 28, 1913, the fair market value within thirty days after date of discovery, should be the amount to be allowed as a deduction for depletion for such natural resources. This provision has been re-enacted in the law of 1921. Much of existing natural resources fall in that class whose value yet remains to be determined "within thirty days after date of discovery." Just when a mineral deposit may be said to be discovered is a difficult thing to determine. Presumably it is not when the ore body is merely located by prospecting but when the mineral is uncovered through developmental work.[10]

Gower suggests that:

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[9] See Appendix D.

[10] See *Reg.* 62, Art. 219.

> . . . the term discovery as used in the statute, and applicable to mines, must apply to the development of all ore beyond the range and in the case of producing mines would cover the entire prospective value to be developed by extension of the deposit beyond a short distance from the last opening.[11]

The discovery and development of new natural resource values may thus be a more or less continuous process.

Development of Theory of Depletion

Until the advent of income taxation the most authoritative interpretations of the theory of depletion were to the effect that the depletion allowance should be based strictly on original cost, and that the only effect of new discoveries is to lessen the amount of depletion allowable per unit of output. This plan has been described by A. Lowes Dickinson, C. P. A., as follows:[12]

> . . . As a general principle, whatever there was in the ground, whether known or unknown, has been reduced during the period under consideration by whatever amount has been extracted; and while the new discoveries may be accepted as reducing the necessary rate of provision for extinction from, say, one dollar to one cent per unit of quantity, the original principle that provision must be made holds good on the smaller figure, whatever it is. It may be, of course, that the provisions made in earlier years have been sufficient to cover a number of future years on this basis, from the commencement, of the rate subsequently found to be sufficient in view of the new discoveries; and in this case there would be no necessity to provide further for extinction until the total production at the new rate is equal to the total amount written off.

For a long time accountants regarded this position as correct. Its practical application necessitated the frequent revision of the depletion allowance per unit of output where, as in case of copper mines, new discoveries are continually being made. Under this plan the charge per unit of output continues at all times to be a fraction of the original cost of properties, but the denominator which determines the amount of that fraction—the changing amount of known existing tonnage—changes with each new discovery; consequently the depletion per unit of output also changes.

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[11] *Journal of Accountancy*, XXVIII, p. 365. This statement has reference to copper mines.

[12] *Accounting Practice and Procedure*, pp. 172-73.

The application of the income tax led to a reconsideration and revision of these views. The status of its theory and its application have been stated as follows:[13]

Theory:

1. That gradual exhaustion of the ore body is an element of expense which should be taken up in each and every fiscal period during which minerals continue to be won from the mine, at a more or less constant rate per ton.
2. That the total expense of this character to be absorbed in the operating accounts is the intrinsic value of the mine content (in place, *en bloc*) which existed from the beginning, although much of it may have been latent and determined only by "extension in depth."
3. That by the term "intrinsic value of the mine content" as used above is meant the product of two factors:
   (a) The tonnage of mine content as finally ascertained.
   (b) A unit price per ton representing the bed-rock value of the average grade of ore, in place, *en bloc,* including proved ore, probable ore, and prospective ore, estimated at the commencement of business. In bed-rock value the price of metals in estimated mine content is calculated at some figure between "basic" and "normal"; cost of production and selling is calculated at maximum probability; the rate of mining and the life of the property must be estimated; from these factors a discounted or present value at true rate of interest is obtained; and this capital value is

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[13] Gower, William B., in the *Journal of Accountancy,* Aug., 1918, pp. 85-86.

then reduced by a substantial value due to the element of risk.

Application of theory:

1. The depletion expense of each and every fiscal period during which mining operations occur is the tonnage of ores extracted multiplied by the more or less constant rate per ton established by original estimate of value in place.
2. The rate per ton of ore extracted, for purposes of the depletion expense computation, would change only in the event of subsequent discovery of relatively large bodies of ore of a grade differing widely from the original estimates.
3. In the case of "extension in depth" developing new values it may be necessary from time to time to adjust the book value of the mining property, in order to harmonize with intrinsic value.

Problem of Valuation

The adoption of the theory of depletion as stated by Gower necessitates the occasional adjustment of book values of natural resources to keep them in agreement with progressive development resulting from new discoveries. In case of valuations made as of March 1, 1913, to bring the books into agreement with the fair valuation as of that date a special surplus account should be credited with the increase.[14]

The regulations governing the methods of making valuations of mineral deposits were last revised as of December 29, 1920.[15] Changes in these are made so frequently that it is unwise to attempt to enter here into a discussion of the details of the requirements. The main requirements are that the valuation as of a specified date must be made "in the light of conditions and circumstances known at that date, regardless of later discoveries or developments in the property or subsequent improvements in methods of extraction and treatment of the mineral product."[16] The value should be such as would be established as the result of a bona fide transfer between a willing buyer and a willing seller as at the date in question. All factors which may be regarded as capable of throwing light on such valuation may be taken into consideration by the Treasury in ascertaining whether or not it has been made fairly.

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[14] Montgomery suggests that each year a transfer should be made from this special surplus account to general surplus, because as soon as such revaluations are realized they become additions to invested capital for purposes of the excess profits tax. (*Income Tax Procedure*, 1921, p. 926.)

[15] *T. D.* 3102. This is incorporated in *Reg.* 62, Arts. 201-24, inclusive.

In all cases except where cost serves as a basis for the determination of depletion charges the Treasury requires that the basis shall be the fair market valuation as of a "basic date," i.e., March 1, 1913, in case of property acquired before that date, the date of acquisition in case of property acquired on or after March 1, 1913, or the date of discovery,[17] or within thirty days thereafter in case of property discovered after March 1, 1913. The "fair market value" of a property is that amount which "would induce a willing seller to sell and a willing buyer to purchase."[18] There are, however, many ways of determining such an amount, and it is therefore necessary to employ a method of valuation which is comprehensive enough to be really scientific.

The Treasury regulations provide that where the fair market value as of a given date is to serve as the depreciation base such valuation must be determined "in the light of conditions and circumstances known at that date, regardless of later discoveries or developments." One prominent engineer suggests, however, that an engineer could not be expected to "stultify" himself by ignoring such later developments as would aid in determining value as of a past date.

Following the practice of competent mining engineers the

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[16] *Reg.* 62, Art. 206.

[17] The privilege of revaluation within thirty days of discovery applies only where the discoverer is the taxpayer. Thus a lessor cannot claim any part of the value of a discovery made by a lessee.

[18] *Reg.* 62, Art. 201.

Treasury has adopted the present value method of valuation; but the Commissioner considers any and all factors and evidence which throw light on what market value is. Among these are: cost, actual sales and transfers of similar properties, market value of stocks or shares, royalties and rentals, value fixed by the owner for purposes of the capital stock tax, valuation for local or state taxation, partnership accountings, records of litigation in which the property was in question, the amount at which the property may have been inventoried in probate court, and disinterested appraisals by approved methods. It is well known, however, that many of the ordinary evidences of value are not good criteria in case of mines and oil and gas wells, because of the dissimilarities existing between even those properties which lie in juxtaposition.

The Present Value Method

Following the organization of the Natural Resources Division of the Income Tax Unit of the Treasury a careful study of the subject of valuation and depletion was made.[19] As the result of this study certain principles were recognized as applicable to the problem of taxation and valuation of natural resources. Among these were the following:[20]

1. Increase in mine values is not unearned increment since the work of development merely develops what already existed in the ground; it does not add to values in the sense that the value of real estate is enhanced by community development, improved methods of transportation, and so on.
2. That exhaustible capital values must be recognized.
3. That an allowance must be made not only for the return of cost but also for the replacement of exhausted mineral.
4. That mining must be regarded as a continuing industry, because organizations built up to engage in the success-

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[19] See Appendix C for letter explaining the Treasury's method of mine valuation and use of Hoskold's formula.

[20] Stated by Norris, R. V., in *Columbia Income Tax Lectures* (1921), pp. 227-28.

> ful exploitation of mines are of too great value to be permitted to be discontinued by the exhaustion of any one property.

Valuation as of March 1, 1913, is perhaps the main problem because most properties have not changed hands since that date.

Factors to be Determined.—The present value method has received the sanction of the United States Supreme Court,[21] of the American Institute of Mining and Metallurgical Engineers, and of many competent individual authorities. To determine the fair market value of a property by this method the following essential factors must be determined for each deposit:[22]

1. The total quantity of mineral in terms of the principal or customary unit (or units) paid for in the product marketed.
2. The average quality or grade of the mineral reserves.
3. The expected percentage of extraction or recovery in each process or operation necessary for the preparation of the crude mineral for market.
4. The probable operating life of the deposit in years.
5. The unit operating cost, i.e., cost of production exclusive of depreciation and depletion.
6. The rate of interest commensurate with the risk for the particular deposit.

In case of properties which are well developed much of this information can be secured from past operating experience, full allowance being made, of course, for probable future variations in rate of exhaustion, quality of mineral, percentage of recovery, and of costs of producing and selling. If past operating experience is lacking, the information may be deduced from concurrent evidence. A very important provision of the Treasury regulations is that deposits of different grades, locations, and probable dates of extraction shall be valued separately.

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[21] *Cleveland, Cincinnati, Chicago & St. Louis Railway Co. v. Backus*, 154 U. S. 439.

[22] *Reg.* 62, Art. 206.

Finding Present Market Value.—Utilizing the information required, the present market value is found by—

1. Finding the total expected operating profit, secured by multiplying the number of units of mineral recoverable in marketable form by the difference between selling price and operating cost per unit.
2. Reducing the total expected operating profit for each mineral deposit to a present value as of the basic date (March 1, 1913, or a later date) at the rate of interest commensurate with the risk involved. This value should be further reduced by the value, as of the basic date, of the depreciable assets and prospective capital additions essential in the process of realizing said profits.

Segregation of Minerals.—Minerals which cannot be mined before a definite future period in time should be classed separately. It is the suggestion of the Mines Taxation Committee of the American Institute of Mining and Metallurgical Engineers that no mine be valued on an estimated operating life of more than forty-five years. R. V. Norris suggests that:

> . . . a proper time limit for available mineral shall be such that its present value on an annuity basis would be ninety per cent of the present value of an infinite amount, i.e., a perpetual annuity. At six per cent discount rate this time limit would be forty years life, and at eight per cent, thirty years, which may properly be considered as a maxima.[23]

Of mineral which cannot be extracted within, say, forty years, there are two kinds: (1) known reserves, and (2) unknown deposits subject to future discovery. For known minerals which cannot be worked within forty years little is paid, because the discounted value of a dollar due in forty years is a small amount. Depletion per unit of output should be based on the amount which can be extracted, say, within forty years; for if additional quantities were included the depletion per unit would be too small. The taxpayer pays most for that mineral which he extracts first and least for that which he extracts last, and if minerals which cannot be mined within a reasonable time are included in determining the depletion charge the inequality resulting from distributing the depletion deduction equally over all units to be extracted becomes very great.

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[23] *Columbia Income Tax Lectures* (1921), p. 230.

All quantities of mineral not to be extracted within a reasonable time should therefore be segregated as an investment not subject to depletion. When such reserves are ultimately worked there will be no deduction for depletion except in case of new discoveries, or in case of a valid transfer, because the total investment will have been returned before the reserves are exploited. The principles here discussed should be applied in connection with the Treasury regulations for determining the quantity of mineral in a mine, which require that:

> Every taxpayer claiming a deduction for depletion for a given year will be required to estimate or determine . . . the total units of mineral products reasonably known or on good evidence believed to have existed in the ground on the basic date. . . .

Clearly, since purchases of mineral are made on the basis of what can be extracted within a reasonable time, those which cannot be extracted within such a reasonable time should not be considered in determining the depletion to be taken for each unit extracted. In this connection it may be noted that it is not advantageous to make "discoveries" long in advance of the time when they can be exploited since the estimated profits to be derived from them must be discounted to a present value basis.[24]

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[24] See *Reg.* 62, Art. 219.

It is obvious, of course, that all factors necessary to the solution of the problem cannot be determined with absolute accuracy, and consequently the expected future profits can, at best, be stated only as approximations.

VALUE AT GIVEN DATE.—The valuation as at a given date for depletion purposes is:

The amount secured by discounting, at compound interest, to that date, the total net profits year by year, less

The discounted value, at the basic date, of the depreciable assets and capital additions thereto necessary to realize the profits.

The amount thus secured, when applied to the estimated available tonnage, for depletion purposes, will return the value of the property when the estimated tonnage is exhausted. It has been suggested by the Engineers Committee of the National Coal Association that the basis for determining the amount to be allowed during any one accounting period be based on earnings instead of on the amount of ores extracted, so that the burden would be more equitably distributed, prosperous years bearing a heavier burden and lean years a lighter one than would be the case if the depletion is applied on a tonnage basis.

THE RATE OF INTEREST.—There has been considerable discussion and disagreement as to what is the proper rate of interest to be used for discount purposes in determining value as of a basic date. It is a problem which involves certain difficulties, such as the element of risk involved, changing rates of interest over periods of many years' duration, and so on. Norris considers 6 per cent the proper rate in most cases, since it has the authority of being a standard legal rate. He suggests, however, that a higher rate may be used where there is question as to the extent or continuity of the deposit.[25]

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[25] *Columbia Income Tax Lectures* (1921), p. 235.

The Mines Taxation Committee of the American Institute of Mining and Metallurgical Engineers suggests a rate of 4 per cent, compound interest. The Treasury is using 6 per cent for anthracite mines and 8 per cent for bituminous mines. C. E. Grunsky[26] thinks that the rate should vary with the risk involved. This in turn varies with the stage of development of the mine and with different kinds of mines. Hoover[27] lists the risks of mining as follows:

1. The risk of continuity in metal contents beyond the sample faces.
2. The risk of continuity in volume through the blocks estimated.
3. The risk of successful metallurgical treatment.
4. The risk of metal prices, in all but gold.
5. The risk of properly estimated costs.
6. The risk of extension of the ore beyond exposures.
7. The risk of management.

Some of these risks occur in industrial enterprises; others are peculiar to the mining industry. At first thought it appears reasonable that, since the rate of return on investments varies with the nature of the enterprise—mining investments ordinarily returning a higher rate than industrials—this should be taken into consideration in arriving at the present value of mineral deposits. J. R. Finlay, however, is of the opinion[28] that a normal discount rate of 5 per cent should be used. Apparently he does not consider risk an element in the determination of the discount rate to be used in a mine valuation because it is "nothing but a candid inquiry into the present value of expected profits." If "expected profits" takes into consideration the risks involved, then it would seem proper to employ such a normal discount rate.

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[26] *Valuation, Depreciation and the Rate Base,* p. 241.

[27] *Principles of Mining,* p. 182.

[28] *Valuation of Iron Mines,* Trans. American Institute Mining Engineers, XLV, p. 295.

Probably the trouble results from confusing the rate of return which a mine investment should provide and the rate of discount necessary to determine the present value of expected future profits. The two are entirely different concepts. The greater the apparent risk involved the greater will be the expected return on the investment; but the risk and the expected return are opposing elements which tend to reduce all expected future profits to a common level. In other words, if in stating the expected future return we make allowance for the risk involved, we should not make allowance for it again in the discount rate. But if we do not make allowance for the risk in stating the expected returns it is proper to do so by using a higher rate of discount where higher risks are involved. It does not appear that the few possible rates of discount that are suggested, varying from 4 to 10 per cent, would be accurate measures of risk; consequently it would seem better procedure to reduce future earnings to what appears to be assured under the circumstances and then use the normal interest rate to reduce this to its present worth. In this case, of course, while present value would be determined in all cases by the employment of a uniform discount rate, actual rates of return in future years would vary according to conditions. This might be 10 per cent on the capital invested plus a rate of return sufficient to redeem the investment; whereas for determining a present valuation a normal discount rate of 6 per cent might be employed in reducing to their present value future profits which are first discounted for risk involved.

Who May Claim Depletion Deductions

If the operator holds the property in fee the capital remaining recoverable in the form of allowances for depletion and depreciation is:

1. Cost or value of the property at the basic date, plus
2. Subsequent capital additions thereto, minus

3. Depletion and depreciation already sustained, whether legally allowable or not, from basic date to the taxable year, and also minus
4. Value of the land as at the basic date for other purposes.[29]

Having thus determined the total amount recoverable, the amount recoverable for depletion is such total amount less the amount recoverable for depreciation.

A stockholder cannot make a deduction for depletion because the total allowable should be deducted by the corporation which pays dividends to the stockholder.

Lessors and Lessees.—In case of lessors and lessees the 1921 law provides that the deductions for depletion "shall be equitably apportioned between the lessor and lessee." The regulations[30] for determining the amount of capital at any given time remaining returnable as depletion deductions for lessees are the same as given above for operating owners, except that the value of the land for other purposes is not returnable to the lessee. This is because the lessee has no interest in such use of the land. Bonuses paid by the lessee are a part of the cost of the leasehold; likewise any annual or periodical rents or flat royalties which are supplementary to the amount paid for the lease when acquired are a part of the cost of the lease until the property begins to operate. Other items additional to the purchase price of the lease which enter into the cost to be depleted are: salaries or commissions paid to brokers or agents; fees to geologists, attorneys, surveyors, etc., for professional services; state and county fees for legalizing transfers and recording; as well as any other costs essential to the acquisition and establishment of the title.

In addition such development costs as the following should be capitalized:

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[29] *Reg.* 62, Art. 202.

[30] *Reg.* 62, Art. 203.

1. Physical property
2. Geological and other surveys, made subsequent to acquisition
3. Roads
4. Water supplies
5. Hauling
6. Wages
7. Drilling
8. Shooting
9. Overhead charges
10. Fuel
11. All other necessary expenditures

When a lessor receives bonuses in addition to royalties they are to be regarded as a return of capital and are, therefore, not taxable; only, however, to the extent of the capital remaining to be recovered through depletion as determined by its amount at the date of the lease.[31] To the extent that the bonus exceeds such recoverable capital it is income, as are also all royalties received thereafter. The bonus or other sum paid by the lessee on or after March 1, 1913, determines his valuation for depletion purposes.

Advance royalties are an allowable deduction from the gross income of the lessor for the year in which they are received. When, later, the minerals for which such royalties were paid are removed no further deduction can be claimed by the lessor. If, however, through the expiration of the lease, the lessor should repossess the property before all such minerals for which such advance royalties have been paid are extracted, the lessor must restore to the capital sum of the property the deductions for depletion made on account of royalties received for minerals which were not removed. This sum must also be included as income in the year in which such lease is terminated and repossession taken.[32] It would appear to be more equitable to permit him to make amended returns.

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[31] *Reg.* 45, Art. 215.

[32] *Reg.* 62, Art. 215 (c).

Likewise, if the lessor comes into possession of his property because of the expiration, termination, or abandonment of the lease before any or all of the minerals have been removed for which the lease provided, he must restore to capital as much of the bonus received and deducted as a depletion allowance as exceeds the actual loss sustained from operations under the lease. Such amounts returned to capital must be included in taxable income for the year in which the lease expires, terminates, or is abandoned. Here, too, amended returns would be more equitable.

The regulations provide that the equities or interests of lessor and lessee shall be computed separately, but when they are determined as of the same basic date they cannot together exceed the value in fee simple.[33] The lessee's equity is the value, as of the basic date, of his interest in the minerals; or if the lease is made after the basic date, the discounted value, as of the date of the lease, of royalties to be paid under the lease. The lessor's equity as of the basic date is the discounted value of royalties to be received. If not leased until after the basic date the lessor's equity is the *en bloc* value of the minerals as of such basic date; but if it is leased later it cannot exceed the discounted value of future royalties. These values are subject to the provision above stated that, when there is a common basic date the equities of lessor and lessee cannot exceed the fee simple.

In case of term leases, which are not expected to exhaust the leased property, the value as of the basic date consists of the discounted value of the royalties provided under the contract plus the discounted value of deposits which will not be exhausted under the lease.

The apportionment between lessor and lessee discussed above was specifically provided for in the laws of 1918 and 1921, but not in the law of 1916. In a case[34] falling under the 1916 law the district court decided that a lessee was entitled to a deduction for depletion, but this decision was reversed by the circuit court of appeals. In reversing the decision of the district court the circuit court relied largely on a decision which came under the excise law of 1909 and which was decided on special grounds which governed in the *Biwabik Case.*

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[33] Norris thinks that this provision should be subject to the exception that value based on royalties receivable is the only proper basis for the lessor's equity, so that if the lessee pays too much, the lessor should still be entitled to depletion deductions based on the lease's value without reference to the value of the fee simple. *Columbia Income Tax Lectures* (1921), pp. 226-27.

A lessor, in paying his income tax, can deduct expenses and also depletion based on the value of his interest as of March 1, 1913, if acquired before that date, on the basis of cost if acquired thereafter, or, in case of discoveries of mines and oil wells, on the basis of its fair market value at the date of discovery or within thirty days thereafter. He may make a deduction for depletion on royalties received even though no mineral, or a less quantity than corresponds to the amount claimed, has been extracted. Later, however, if it appears that his depletion deduction has been excessive the excess must be returned as income in the year in which such is ascertained to be the case. This will ordinarily be the year in which he regains possession of the property. It has been remarked that this is inequitable and that the lessor should be permitted to make amended returns.[35]

PRINCIPLES ILLUSTRATED.—The following illustration taken from the *Manual for the Oil and Gas Industry* will make clear the various principles discussed above.

> A's invested capital in a leasehold on March 1, 1913, was $200,000.
>
> His estimated oil reserves on that date were 2,000,000 barrels.
>
> Under the Act of 1913, the lessee was not allowed a re-

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[34] *Mohawk Mining Co. v. Weiss, Collector,* U. S. Dist. Court, Northern District of Ohio, Eastern Division (decided Nov. 3, 1919; reversed June 15, 1920, 264 Fed. 502).

[35] Montgomery, R. H., *Income Tax Procedure,* 1921, p. 946.

valuation for purposes of computing his depletion deduction from gross income. And the depletion taken could not exceed 5 per cent of the value of the oil at the well.

$\frac{200{,}000,}{2{,}000{,}000}$ or 10 cents, represents the unit cost of each barrel of oil in the property at that date.

He extracts and sells—

200,000 barrels in 1913 for	$100,000
150,000 barrels in 1914 for	90,000
125,000 barrels in 1915 for	60,000
100,000 barrels in 1916 for	50,000
75,000 barrels in 1917 for	100,000
He has sold 650,000 barrels for	$400,000

	Depletion Sustained	Depletion Allowed
1913	$20,000	$ 5,000
1914	15,000	4,500
1915	12,500	3,000
1916	10,000	10,000
1917	7,500	7,500
Total	$65,000	$30,000

For purposes of taxation in 1918 A's invested capital is $200,000 — $65,000 = $135,000 and not $200,000 — $30,000 = $170,000.

The Revenue Act of 1918 allows A to revalue his property as of March 1, 1913. The valuation ("Capital Sum") claimed by A and allowed by the Commissioner was $1,000,000.

The unit cost for purposes of computing depletion deductions from capital assets is $\frac{\$1{,}000{,}000}{2{,}000{,}000}$, or $0.50 per barrel.

The total depletion of capital sum to January 1, 1918, was, therefore, 650,000 × $0.50 = $325,000.

Capital sum at January 1, 1918, is, therefore, $1,000,000 — $325,000, or $675,000, and not $1,000,000 — $30,000, or $970,000.

DEPLETION BASE FOR LESSOR AND LESSEE ILLUSTRATED.—Each unit of mineral extracted, before a profit results, must pay its proportionate share of total production cost. These include both operating expenses and deductions for depletion and depreciation. That share of the capital sum returnable through depletion which is applicable to each unit of output is the unit cost. It is obtained by dividing the capital sum to be depleted by the recoverable minerals as at the beginning of the taxable year. The depletion deduction for the taxable year is secured by multiplying the unit cost by the number of units produced during the taxable year. In case of a division of the capital sum between lessor and lessee for purposes of depletion, the unit cost for each is secured by dividing the capital sum allocable to each by the number of units. Ordinarily this will result in a higher unit cost for the lessee than for the lessor, because his investment is usually greater. In other words, the amounts deducted for lessor and lessee, respectively, are proportionate to their capital sums. Following are illustrations of the method of determining the depletion allowance of lessee and lessor:[36]

First, when the lessor receives no bonus:

A, a lessee, has an oil lease in which his original investment (exclusive of value of physical property) was	$ 20,000
Development cost (exclusive of cost of physical property) not otherwise deducted	80,000
Capital returnable through depletion allowance	$100,000
Estimated gross recoverable reserves at end of taxable year, barrels	400,000
Gross production during taxable year, barrels	100,000
Gross reserves at beginning of year, barrels	500,000

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[36] Taken from *Manual for the Oil and Gas Industry*, p. 31.

Lessee's share, (⅞), barrels	437,500
Lessor's share, (⅛), barrels	62,500
Total, barrels	500,000

Therefore unit cost for lessee is $\frac{\$100,000}{437,500}$, or, per barrel	$0.2285
Lessee's share of production during year is ⅞ of 100,000, or, barrels	87,500
A's depletion allowance for the taxable year is, therefore, 87,500 × $0.2285	$19,993.75

B, the owner in fee of the property, had invested.	$40,000
Of which the value of the land exclusive of oil rights represents	25,000
The investment in the oil deposit is	$15,000

B's unit cost is, therefore, $\frac{\$15,000}{62,500}$, or, per barrel	$0.24
Lessor's share of production is ⅛ of 100,000 barrels, or	12,500
And his depletion allowance for the same year is 12,500 × $0.24, or	$3,000

Secondly, when the lessor receives a bonus:

The lessor's (B's) investment in the deposit is	$15,000
He receives as bonus	5,000
His net investment in the deposit is, therefore	$10,000
He sells a one-half interest in his royalty for	$ 6,000
As this half cost him	5,000
His profit is	$ 1,000
And is subject to tax as income.	
His capital sum remaining is	$ 5,000
If he had sold a one-half interest in his royalty for	4,000
He would have sustained a loss of	$ 1,000

He should deduct this amount from gross income as a loss in computing his tax.

In 1920 the Solicitor of Internal Revenue held [37] that a lease to mine coal which gave the lessee the right to mine, remove, and dispose of all the coal which he could by diligence remove during the period of the lease did not constitute a sale and that the royalties therefrom are income to the lessor. The Solicitor also held that the annual deduction allowable to the lessor for depletion is to be determined by dividing the fair market value of the entire body of coal in place on March 1, 1913, by the estimated content of the mine in tons and multiplying the result so obtained by the number of tons of coal taken out each year. This permits the lessor to deduct the whole capital sum as depletion, and assumes no investment on the part of the lessee. Otherwise it corresponds with the method prescribed above, assuming that "fair market value" and "capital sum" are equivalent terms.

In a later opinion [38] the Solicitor of Internal Revenue says that in the case under consideration the present worth to the lessor as of March 1, 1913, should be determined by multiplying the royalty of 20 cents per ton by the number of tons of probable extraction by the lessee, discounting the product thus secured for the remaining life of the lease, and adding to such discounted sum the value of the ore which would be left in the mine at the termination of the lease. A reasonable allowance to the lessor, in this case, was declared to be such present worth, determined as explained above, provided this did not exceed fair market value, as prescribed by the Revenue Act of 1916, under which this case arose.

It has been held that where a lessee makes a discovery the lessor is not thereby prevented from securing his proper proportion of such discovery value.[39] For details see footnote citations.

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[37] *Solicitor's Memorandum* 1365, 18-20-900.

[38] *Solicitor's Opinion* 80, 5-21-1418.

[39] *T. D.* 3089, 47-20-1313.

Lease versus Sale

It is sometimes necessary to distinguish between a sale and a lease for purposes of determining the depletion deduction. If a sale has been consummated the consideration given determines the amount of the deduction; if not, the cost to the lessor or its value as of March 1, 1913, or within thirty days after discovery, determines it. A contract permitting one company to enter upon the land of another and cut and remove timber does not constitute a sale of timber, but is license to enter and remove lumber.[40]

Past Depletion

The present regulations require that past depletion, whether or not it was taken, must be deducted from the capital sum returnable through depletion deductions.

Depletion, Invested Capital, and Capital Sum

Invested capital for purposes of the excess profits tax is not the same as value for depletion purposes.[41] In fact, there appears to be a greater distinction between market values and invested capital in case of mines and other natural resources than in case of most industrial enterprises. It has been suggested that where new values of reasonably ascertainable amounts have resulted from explorations and developments, these should be regarded as earned surplus and included in invested capital.[42]

If any reserves for depletion or depreciation have been included in surplus they must be taken out and given their proper names, since only true surplus is a part of invested capital. Of course to the extent that such reserves may be excessive, they are true surplus and should be so considered. Also, where depletion or depreciation is computed on a valuation determined as of March 1, 1913, or a subsequent date, and where such valuation exceeds cost, "the proportion of depreciation or depletion representing the realization of appreciation of value at March 1, 1913, or such subsequent date, may if undistributed and used or employed in the business be treated as surplus and included in the computation of invested capital."[43] This is the only instance in which value appreciation which has not been actually realized and reported as income for income tax purposes can be included in invested capital.[44]

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[40] *Committee on Appeals and Review Memorandum* 111, 9-21-1480.

[41] See pp. 229-232 for a discussion of depreciation and invested capital and of the elements of which invested capital is composed.

[42] Taxation Committee of the American Institute of Mining Engineers.

When certain incidental expenses, such as cost of wagons, fuel, repairs, and hauling, are incurred in connection with the work of exploration, drilling of wells, and other developmental work, the taxpayer may deduct them as current expense or charge them to capital account and have them returned through depletion or depreciation allowances. Likewise the cost of drilling unproductive wells may be charged to expense or be capitalized. Whichever method is adopted must be continued. If such costs are charged to expense account they cannot be included in invested capital.

INVESTED CAPITAL VERSUS CAPITAL SUM.—The "invested capital" must be clearly distinguished from the "capital sum." "Invested capital" is the actual cash or its equivalent paid in plus surplus and undivided profits, and includes no appreciation except as above stated, whereas the "capital sum" is the total amount returnable through depletion, depreciation, and obsolescence allowances.[45] The "capital sum" may represent borrowed funds, which cannot be a part of invested capital. It may also include amounts based on a valuation made as of March 1, 1913, or within thirty days after date of discovery of a mine or of oil or gas. Except as noted, such valuations do not affect invested capital. The distinction between the capital sum and invested capital is clearly shown in the following quotation from the *Manual for the Oil and Gas Industry*:[46]

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[43] *Reg.* 62, Art. 844.

[44] In *La Belle Iron Works v. The United States* (decided May 16, 1921), the United States Supreme Court decided that depreciation is not a part of invested capital. Yet the appreciation disallowed as a part of invested capital was undoubtedly included in fair market value as of March 1, 1913, upon which depletion was computed by the company. According to Article 844 of *Reg.* 45, to the extent that such market value exceeds cost, it may be included in surplus and invested capital to the extent that it has been returned through depletion. The decision does not appear to be in conflict with the provision of Article 844 of *Reg.* 62, since addition to surplus resulting from depletion of values greater than cost is distinctly realized, whereas the appreciated value to which the court referred "has not been realized or tested by sale made." The court may have had this in mind when it said: "We intimate no opinion upon the effect of the act with respect to deductions from cost values of capital assets because of depreciation or the like; no questions of that kind being involved." See editorial in the *Journal of Accountancy,* July, 1921, pp. 46-52. The full text of the decision in the *La Belle Iron Works Case* is printed in the same issue, pp. 53-58.

> A corporation had a paid-up capital stock of $50,000. This amount was invested in oil and gas property, and in addition the corporation had incurred liabilities due to developing the property and the purchasing of equipment at the beginning of the taxable year amounting to $50,000. The property was found to have a value of $150,000 in accordance with the valuation accepted by the Commissioner. The allowable deductions for depletion and depreciation in determining the net income of the corporation are computed on the value of $150,000. The actual invested capital for the purpose of calculating the tax due for the taxable year from the corporation is $50,000. However, in the succeeding taxable year a part of the aggregate allowance for depletion and depreciation (proportionate to the part of the capital sum representing appreciation) may be included in invested capital in accordance with the provision of article 844 (2) of Regulations No. 62. The following statement is prepared to illustrate the application of the rule to the case cited:
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> Assuming the total deduction for depletion, depreciation, and obsolescence from the gross income to be 10 per cent of the valuation accepted by the Com-

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[45] *Reg.* 45, Art. 831.

[46] Published by the Government Printing Office, revised Aug., 1921, as a guide to owners and lessees of oil and gas properties. Copies can be obtained from the Superintendent of Documents, Washington, D. C., at 25 cents each. This manual contains 245 pages and gives much valuable information to taxpayers concerning experience as to lives of wells in various fields as well as the general principles of depletion as applied to this industry.

missioner, the amount deductible for the taxable year would be	$15,000
Amount of depletion, depreciation, and obsolescence calculated on the cost of the property is	10,000
The amount of realized appreciation which may be added to invested capital for the succeeding year is	5,000
Assuming that all the earnings are distributed, except the depletion and depreciation reserves, at the beginning of the succeeding taxable year, the invested capital would be	55,000
The cost of the property would be	90,000
The appreciation in value would be	45,000

Both the cost of a property and its cost of development,[47] in so far as not reduced by deductions which have been or should have been made, are chargeable to the capital sum subject to return through appropriate depletion or depreciation deductions. It is optional with the taxpayer as to whether he shall capitalize development costs and then secure their return through proper deductions, or deduct them as an expense in the year in which they are incurred. He cannot change his method, however, once he has chosen one plan or the other.

Expenditures Not Part of Capital Sum

Expenses and repairs which are incurred in connection with the development and operation of *producing* properties should not be capitalized and added to the capital sum; they represent current charges to profit and loss. Expenses include pumping, cleaning, reshooting (including cost of torpedoes), gauging, storing, treating, reducing, costs of repairs, maintenance, transportation, conservation, marketing, overhead expense, insurance, and so on. If extensive replacements are charged as repairs, the depreciation allowance should be correspondingly diminished. All items of expense must be charged off in the year in which incurred. They cannot be added to the capital sum or be deducted in later years. This does not mean that developmental costs of *non-producing* properties cannot be capitalized and so become a part of the capital sum. Improvements and betterments are also properly capitalized and returned through depreciation deductions.

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[47] See p. 69.

Depletion of Gas and Oil Properties

The Treasury regulations require that an estimate be made of recoverable oil in the territory in question as of the date of purchase, or as of March 1, 1913, if acquired prior to that date, or within thirty days after discovery. They do not, however, prescribe any method of estimating recoverable reserves. Methods of doing this which are applicable to a wide variety of conditions are described in Part III of the *Manual for the Oil and Gas Industry.* These methods are based upon the underlying principle that "the best indication of the future production of any well is to be found in the history of similar wells in the same or similar districts, and that, other things being equal, a well's production is more likely to approximate the production of a similar well in the tract or district than to deviate widely from the average."[48] These methods are summarized as follows:

1. Plotting the record of production of individual wells, or, lacking such detailed information, the average production per well for each tract.
2. Deriving from these graphical records an average or composite production decline curve for the district.
3. Estimating from the last year's average production per well the probable future production, based on the average production decline curve, or a future production curve derived from the production decline curve.
4. Ascertaining probable total future production of producing wells by multiplying average future production per well by the number of wells producing at the end of the year.

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[48] *Manual for the Oil and Gas Industry* (1918), p. 27.

The authors of the *Manual for the Oil and Gas Industry* emphasize the fact that the value of the estimates made according to this plan will depend almost entirely upon the skill with which it is used and the character of the production records upon which they are based. Whatever method of estimating recoverable reserves is used by the taxpayer, he must submit the data upon which they are based, a description of the method employed, and a résumé of his calculations.

The depletion of natural gas properties is usually computed on the basis of decline in closed or rock pressure, due allowance being made for water encroachment and other modifying factors. The reader is referred to the Treasury regulations [49] and to the *Manual for the Oil and Gas Industry* [50] for further details as to the method of computing depletion for gas wells.

In connection with the exploration of property and drilling of new wells a company may exercise an option as to whether it shall charge expenditures incurred in such operations for wages, fuel, hauling, and so on, to capital account or to operating expense.[51] If, however, it elects to charge them to operating expense it cannot revise its accounts and transfer them to capital. Similarly it cannot transfer to operating expense expenditures charged to capital.[52]

Depletion of Timber Land

In general, but with certain exceptions resulting from the nature of the lumber industry, the principles already discussed apply to timber.[53] In case of timber acquired after February 28, 1913, the basis is cost, no provision being made for valuations at other than cost for discoveries. For depletion purposes the cost of the timber does not include the cost of the land. The unit value for depletion purposes is determined by dividing the total number of units on hand in the given account [54] at the beginning of the year plus the number of units acquired during the year plus (or minus) the number of units which must be added (or deducted) in order to correct the estimate [55] of the number of units remaining available in the account into the fair market value as of March 1, 1913, and (or) cost of timber on hand at the beginning of the year, plus additions to capital necessary to put the property on a producing basis. The depletion allowance in a given year is the product of the unit value thus obtained multiplied by the number of units of timber cut during that year. Theoretically the depletion occurs at the time of felling the timber, but practically it is determined when the quantity is first definitely ascertained.

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[49] See especially Arts. 211-14, inclusive, of *Reg.* 62 (1920).

[50] P. 32.

[51] *Office Decision* 796, 6-21-1434.

[52] *Committee on Appeals and Review Memorandum* 110, 10-21-1498.

[53] *Reg.* 62, Arts. 227-37.

The fair market value as of March 1, 1913, when once determined and approved cannot be changed during a given ownership. The unit market value or the unit cost may be changed, however, if owing to such changes as those mentioned above the cost or fair market value as of March 1, 1913, will not be extinguished with the exhaustion of the timber.

In case of improvements the cost or value thereof may be written off at a rate corresponding to the current exhaustion of stumpage, or it may be written off in accordance with the usual rules for depreciation, or, finally, according to some plan based on the taxpayer's peculiar circumstances, if approved by the Commissioner; but the cost or value must not be extinguished before the useful life of the plant is ended. Amounts charged off for depletion of stumpage in the years

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[54] Accounts are established for "blocks" of timber, one block to an account. A block is an "operation unit which includes all of the taxpayer's timber which would logically go to a single given point of manufacture." (*Reg.* 62, Art. 236.)

[55] Art. 235 of *Reg.* 62 provides for revision of the estimates of the units of timber available, as they are necessitated by growth of timber, changes in standards of utilization, losses, or abandonment.

1909-1913 cannot be restored to capital account merely because they have been disallowed for income tax purposes.[56]

It has been held that a licensee of Crown Land Limits in the Province of Quebec, Canada, is to be regarded as a lessee for tax purposes and therefore cannot claim a deduction for depletion based upon value of timber as of March 1, 1913. The Crown timber lands are put up for sale annually at public auction; the successful bidder acquires the right, upon payment of the amount bid, to a license to cut timber upon the payment of a yearly rental of so much per square mile and of a stipulated amount per thousand for timber actually cut.[57]

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[56] *Office Decision* 833, 9-21-1489.

[57] *T. D.* 3089, 47-20-1313.

CHAPTER XV

DEPRECIATION AND INCOME TAX LEGISLATION IN ENGLAND

Early Legislation

In 1799 an income tax law was passed in England to enable the government to finance the heavy expenditures occasioned by the Napoleonic wars. This law provided for an allowance for repairs on buildings—3 per cent on farm buildings, 8 per cent in case of a farm with a principal messuage, and 10 per cent in case of houses not connected with a farm.[1]

In 1803 fundamental changes were made in the method of assessment. The plan then adopted has been followed since without notable changes. It divided the income of taxpayers into several schedules and levied the tax at the source. For example, a tenant deducted the tax before paying his rental to the landlord. The tax on landlords came under schedule A and it was levied on the annual value or rack-rent minus certain deductions for repairs, not to exceed 2 per cent of the rent for farm houses or 5 per cent for other buildings, as well as for certain other expenses.

Schedule D included six classes of income. The first was that derived from any trade or manufacture. The tax was computed on an average of three years' profits. No allowance was made for repairs of business buildings and the allowance for tools or articles used in the business was limited to an average of three years. The second class comprised professions, employments, or vocations. The tax was levied on "profits, gains and emoluments" of the preceding year without any deductions. The third class included property of indefinite or uncertain annual value not included in schedule A. These were profits arising from canals, docks, water-works, mines, iron-works, and salt-works, when these were not let at a definite rental. In 1805 a further allowance was granted for repairs under schedule A. In 1806 the allowance for repairs to houses under schedule A was abolished because it was found inadequate and unfair in operation and because it was sometimes claimed where the tenants bore the cost of repairs.

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[1] Seligman, E. R. A., *The Income Tax* (2nd Ed.), p. 79. A "messuage" consists of a farmhouse and adjoining lands appropriated to the use of the household, including the adjacent buildings.

Later Legislation

The Act of 1806 was repealed in 1816. In 1842 a law known as the Property and Income Tax Act was passed, which was virtually a reprint of the law of 1806. It introduced nothing new regarding depreciation. Both the law of 1842 and that of 1853 allowed the actual cost of repairs to be deducted but granted nothing for depreciation. However, the practical application of the English income tax laws gradually became somewhat more liberal than was prescribed in the letter of the laws, so that repairs came to be interpreted as including renewals; and in some instances, ships in particular, permission was granted to write off something for replacement. This practice was recognized by statute in 1878. The interpretation of this law, however, was never very clear, although it became gradually somewhat more liberal. In case of ships it permitted a fixed annual allowance of 4 per cent on cost. For printing machinery no definite allowance was granted, but it was said that "considerable progress has been made in establishing typical rights of allowances on different classes of machinery." The amount of income exempted from taxation because of deductions granted for wear and tear increased from a little over four millions sterling in 1893-1894 to nearly twelve and three-fourths millions in 1902-1903. The allowance granted by legislative act in 1878 was expanded upon in 1897, when the Chancellor of the Exchequer ordered that "when a claim is made in respect of the introduction of more modern machinery into a factory, no objection is to be taken to the allowance, as a deduction from the assessable profits of the year, of so much of the cost of replacement as is represented by the existing value of the machinery replaced." However, this was not proclaimed very widely and many persons remained in ignorance of it.[2]

In 1894 a deduction of one-sixth from the rack-rent value of buildings was permitted, to cover repairs and upkeep, and this presumably was intended to cover ultimate cost of replacement; however, legislation enacted in 1898 provided that for purposes of schedule D only the net amount assessed under schedule A, instead of the full annual value, should be allowed as a deduction. This limited the allowance for wear and tear of buildings to actual expenditures for repairs.

Effects of War Taxation

At the present time (1922) allowances for depreciation are ordinarily limited to machinery and plant; but the burden of taxation during the war has greatly influenced the authorities in the direction of granting more liberal allowances.[3] Ordinary allowances for plant and machinery are granted under general rules; but to secure full advantages of the possible allowances under the excess profits duty it may be necessary to make an appeal.

The original excess profits duty law provided that deductions for wear and tear, renewals, or for the development of a trade or business, should be allowed only in accordance with the allowances already granted under the Income Tax Acts, and if allowed should be only such an amount as the Commissioners of Inland Revenue should consider properly attributable to the particular year or accounting period in question.[4]

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[2] *Report of the Departmental Committee of 1904*, pp. xiii-xv, and Appendix, p. xxxiii.

[3] Haig, R. M., *The Taxation of Excess Profits in Great Britain*, p. 48.

SPECIAL POWERS GRANTED TO COMMISSIONERS.—This provision of the excess profits law apparently limits the deductions for depreciation to those which are granted for the income tax; but special treatment in particular instances was granted by another provision of the law.[5] This was to the effect that the Commissioners of Inland Revenue may allow such modifications of any of the provisions of the fourth schedule as they think necessary owing to "the postponement or suspension, as a consequence of the present war, of renewals or repairs, or to exceptional depreciation or obsolescence of assets employed in the trade or business due to the present war, or to the necessity in connection with the present war of providing plant which will not be wanted for the purposes of the trade or business after the termination of the war, or to any other special circumstances specified in regulations made by the Treasury."

This granted practically unlimited powers to the Commissioners to make such allowances for depreciation as they might see fit where circumstances peculiar to the war made such allowances desirable. Part II, section 24, of the Finance Act of 1918 further provided that where an application is made to the Commissioners of Inland Revenue for an alteration in the amount allowed for wear and tear the Commissioners, unless convinced that the application is "frivolous or vexatious," shall refer the matter to the Board of Referees, which board, if satisfied that the petition is on behalf of a sufficient number of interests, shall determine the proper amount of deduction to be made.

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[4] *Finance (No. 2) Act,* 1915, *Fourth Schedule,* Part I, rule 3.

[5] Part III, sec. 40, par. 3.

OBSOLESCENCE.—The Finance Act of 1918 also gave statutory sanction to ordinary income tax practice in England by providing that in determining the profits or gains of a business there should be permitted to be deducted as expenses in any given year "so much of any amount expended in that year in replacing any plant or machinery which has become obsolete as is equivalent to the cost of the plant or machinery replaced after deducting from that cost the total amount of any allowances which have at any time been made in estimating profits or gains as aforesaid on account of the wear and tear of that plant and machinery and any sum realized by the sale of that machinery or plant."

EXCESS PROFITS DUTY.—Although the allowance for depreciation for purposes of the excess profits duty is normally the same as that permitted for the income tax, it does not follow that an allowance granted *in any given year* for income tax purposes will be permitted to be deducted *in the same year* in determining the excess profits duty. Under the income tax law it is immaterial in the long run whether or not the amounts expended for renewals and repairs is chargeable in one year or over a period of years. But for excess profits tax purposes the time of charging renewals is a material consideration and consequently the Board of Inland Revenue may require adjustments to be made. Thus a limit is placed upon the amount which may be allowed for renewals during the period in which the excess profits tax is in force. To illustrate, assume that an asset requires renewal once in ten years and that for purposes of the income tax the whole amount is permitted to be deducted in the year in which replacement occurs. It is then necessary to make an adjustment in order to secure a fair comparison of earnings of the pre-war period with those of the taxable year. If the rate of depreciation which has been employed for income tax purposes has been inadequate the pre-war income may also be adjusted to correspond to the new rate of depreciation to permit a proper comparison of the two periods to be made. Where the depreciation rate permitted in previous years has been adequate but the rate allowed in the taxable year is inadequate, the allowance for that year may be increased without making adjustments for the preceding period.[6]

If allowance for depreciation on other than plant and machinery is desired it is necessary to make appeal under section 40 (3).

Depreciation Rates

In the United States there is, as yet, no standardization of depreciation rates, except in so far as associations of manufacturers and others have voluntarily agreed upon rates in their own industries. The Treasury Department lays down general rules governing depreciation, but it is entirely with the taxpayer to initiate any rate of depreciation he may choose and to alter that rate when and as he sees fit; although, of course, the government, after auditing his return, may refuse to grant exorbitant deductions. In England, on the contrary, the government, as the result of conferences with the trades, has determined depreciation rates for many industries. In 1918 a White Paper was issued which contained the rates agreed upon up to that date, as shown in the table on pages 311 and 312.[7]

Alteration of Rates.—An amendment to the income tax law, passed in 1918, established a definite form of procedure to alter existing rates and determine others in their places.[8] It provided that reference might be made to a Board

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[6] Haig, R. M., *The Taxation of Excess Profits in Great Britain*, p. 49.

[7] Quoted from Haig, R. M., *The Taxation of Excess Profits in Great Britain*, p. 51.

[8] *Finance Act of 1918*, sec. 24 (1).

INDUSTRY, ETC.	RATE PER CENT	PRIME COST OR WRITTEN-DOWN VALUE	NATURE OF PLANT
Electric Light Undertakings	3	Written-down value	Cables
	5	" "	Plant and machinery
Flax Spinning and Linen Weaving (Ireland)	7½	" "	Machinery and plant (except accessory plant such as pirns, pirn cages, spools, belting, driving ropes, damask cards, designs, patterns, models, furniture and fixtures)
Flour Milling	5	" "	Engines, boilers, and main shafting
	7½	" "	Other machinery
Gas Undertakings, other than those owned by municipal or other public authorities	3	" "	Gasholders
	10	" "	Meters, cookers, and gas fires
Motor Omnibuses[1]	20	" "	Motor omnibuses
Paper Mills	5	" "	Machinery, working day only
	7½	" "	Machinery, working day and night
Printing	5	" "	Engines, boilers, and shafting
	7½	" "	Printing and binding machines
	10	" "	Type
Railway Wagons[2]	5	" "	Railway wagons

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[1] The rate of 20 per cent is to be reconsidered at the expiration of four years commencing with 1916-17. This rate does not apply to commercial motor vehicles.

[2] The allowance applies to all wagons owned by traders. In the case of railway companies the method adopted is to allow the actual cost of renewals year by year.

INDUSTRY, ETC.	RATE PER CENT	PRIME COST OR WRITTEN-DOWN VALUE	NATURE OF PLANT
Shipping[3]	4	Prime cost	Steamships
	3	" "	Sailing vessels
Steel Manufacturers[4]	15	Written-down value	Machinery and plant used in the manufacture of steel
Timber Merchants, Saw Millers, and Manufacturers of Timber Goods	5	" "	Engines, boilers, and main shafting
	7½	" "	General saw-milling plant and machinery
	20	" "	Traction engines, tractors, motor cars, and haulage plant
Tramways[5]	....	....	Permanent way
	3	Written-down value	Cables
	7	" "	Cars and other rolling stock
	5	" "	General plant and machinery, including standards, brackets, and work-shop tools

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[3] With regard to ships *purchased at second hand* at prices in excess of the written-down value at the date of purchase, the following arrangements have recently been made:

(a) The allowance is made on the actual cost price of the ship to the owner for the time being without regard to the prime cost to a previous owner.

(b) The rate of depreciation allowable is calculated by reference to the reasonable expectation of the life of the ship at the date of purchase from the previous owner.

[4] The rate of 15 per cent represents 5 per cent for normal wear and tear, and 10 per cent for the additional wear and tear arising from war conditions.

[5] An allowance per mile of track based upon the estimated life of the permanent way.

of Referees (hitherto of use only in connection with the excess profits tax duty) upon application having been made for alteration in rates permitted for wear and tear when "made by or on behalf of any considerable number of persons engaged in any class of trade or business." In this way deadlocks between taxpayers and the taxing agency are avoided. All depreciation allowances are passed upon first by the local surveyors. They are instructed to deal liberally with taxpayers and settle all except the most difficult problems.

As shown above, section 40 (3) of the law permits great elasticity in the matter of revision of allowances for depreciation. It provides that petitions may be made to the Commissioners of Inland Revenue when, among other things, circumstances arising out of the war make it desirable to modify the existing requirements regarding depreciation allowances. Especially noteworthy is the fact that while normally depreciation allowances are limited to plant and machinery, this special provision applies to "assets employed in the trade or business" and so is not limited to any particular class or classes of assets. Under this provision, patents, for example, may be depreciated if reduction in value results from passage of time and to the extent that it is not offset by growth of goodwill. No allowance, however, is granted for depreciation of goodwill or leaseholds. It should be noted, too, that the provisions of section 40 (3) are sufficiently broad to include property not specifically purchased or used for the manufacture of war materials.

Amortization

The deduction allowable for depreciation or amortization for purposes of the excess profits duty is a liberal one, the total amount deductible being the difference between "war value" (i.e., the value of the asset at the beginning of the first accounting period, when the excess profits duty began to apply, or cost if acquired thereafter) and "postwar value" (i.e., the market value of the asset at the end of the last accounting period subject to the duty, or some other postwar date to be fixed subsequently). This means that total loss in value of assets resulting from war conditions and occurring during the period in which the duty is applicable, may be deducted. Such loss, moreover, is chargeable against the profits of the whole period of the war, and not merely against the period in which it may happen to be disclosed. It has been the practice of the Inland Revenue to hold such cases in abeyance until stable postwar values could be determined. For a time deductions on account of extraordinary depreciation and obsolescence for any one year were limited to 20 per cent, but this was later abandoned, and no definite limit now exists to the amount deductible in a given year.

That part of section 40 (3)[9] which reads "owing . . . to the necessity in connection with the present war of providing plant which will not be wanted for the purposes of the trade or business after the termination of the war" appears to give ample power to the Commissioners of Inland Revenue to deal with any cases involving amortization that might arise as a result of the war.

The war necessitated the suspension, in some instances, of ordinary repairs. Provision was made in the Finance (No. 2) Act of 1915 whereby the Commissioners of Inland Revenue might "allow such modifications . . . as they think necessary . . ." in case of the "postponement or suspension . . . of renewals or repairs. . . ."

Depletion

A deduction for depletion of wasting assets is not a part of British income tax theory. In general, increases and decreases in the amount of capital are not regarded as being related in any way to income. The British income tax is a long-established institution and every purchaser of wasting assets since 1842 may be regarded as having known that his income therefrom would be taxed without any allowance being made for depletion. Under such circumstances the capitalized value of the property would be modified to such an extent as would place net returns derivable therefrom on a basis equivalent to those derivable from other forms of enterprise.

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[9] *Finance (No. 2) Act,* 1915.

However, the excess profits duty could not have been anticipated, and so it became necessary to make some sort of an allowance. The law did not permit a deduction for depletion, but the Board of Referees had it within its power to increase the statutory percentage[10] on invested capital, on appeal, and in this way cases involving hardships were cared for. Professor Haig suggests that the ordinary rates of 6 and 7 per cent may have given some relief, but the additional percentages permitted by the Board of Referees, ranging, for certain classes of mines, from 2 to 21½ per cent, indicate what importance was attached to the depletion question in connection with the excess profits tax.

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[10] The statutory percentage was fixed at 6 per cent in case of a trade or business carried on or owned by a company, and 7 per cent for others, subject, of course, to increases in certain instances. (*Finance (No. 2) Act,* 1915, sec. 40 (2).) The excess profits duty was levied on profits in excess of the statutory percentage, or on profits in excess of average profits of any two of the last three pre-war years, as the case might be. The *Finance Act of 1917,* sec. 26 (2) increased the rate for trades or businesses not carried on or owned by a company or other body corporate to 8 per cent.

PART III

DEPRECIATION AND PUBLIC UTILITY VALUATION

CHAPTER XVI

GOVERNMENT CONTROL OF INDUSTRY

The State's Relation to Industry

For many years preceding the World War there existed a growing tendency on the part of governments to take some part in the regulation, control, and ownership of industry and trade. There were various reasons for this tendency. In part it represented the swing of the pendulum away from the laissez faire or non-interference policy, but in part it represented an innovation made necessary by the changed constitution of the economic world.[1] Competition, although it may still have continued to represent the life of trade, proved inadequate to the task of securing justice where monopolistic tendencies showed themselves very clearly in those fields in which duplication of facilities was too costly to make it economically possible for more than one agency to supply a given service. Monopolistic tendencies also showed themselves in the field of large-scale production, in the form of control of the sources of raw materials and of routes of transportation, as well as through the possession of other advantages which operations over a large territory or on a large plan sometimes create.

In general, state regulation and control of industry is an attempt to substitute a more or less artificial and arbitrary procedure for a natural economic law which no longer functions adequately. It has arisen because of the failure of competition to secure good service and proper treatment for all. But it possesses its limitations and disadvantages. Governments tend more and more towards bureaucracy. The experiences of the World War indicate that, as far as possible, industry and commerce must be permitted to determine their own policies and methods of procedure.

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[1] See Chapter I.

Nevertheless there is a legitimate field for government regulation and interference. Aside from those functions which governments must perform, such, for instance, as the collection of taxes and the exercise of the police power, there is a large twilight zone subject to government control of a more or less mandatory character. The extent to which this control should be extended or reduced is a problem of practical statesmanship.

The Importance of Accounts

Government interference and control is essentially a financial problem. It is an attempt to secure justice to those who use as well as to those who provide services. The interpretation of the results of business activity is an accounting problem, and it is upon a correct statement of such results that government control and interference is made reasonably possible. Taxes cannot be levied, rates cannot be determined, returns cannot be regulated, unless correct accounting principles are applied by all business men. It is not surprising, therefore, that accounting systems, methods, and theories have become the subject of legislative and judicial attention. With the rapid growth of corporate enterprise and the readiness with which large numbers of persons become cosharers in the capital stock of big concerns, however small their respective holdings, there arises the problem of safeguarding their interests. When, owing to absence, ignorance, or other cause, they have no voice in the management of the enterprise which they promote by their investments and to which they look for an increase in, or at least the preservation of, their wealth, they demand a certain amount of protection from the State.

The stockholder is chiefly interested in two things—the preservation of his capital, and the income derived from it. He reads his company's annual report, trusting that the facts are as indicated in the balance sheet and the profit and loss statement. If they are not, he has neither the assurance that his dividend is the real amount of his income nor that his capital is unimpaired. If all proper charges have been made against gross profits for the fiscal period, his dividends represent true profit. If not, profits are overstated and capital is decreased to the extent of the error.

The Problem Analyzed

Government control is based on the theory that there exist certain concepts of an accounting character which can be defined with enough accuracy to enable us to base policies and plans of procedure on the results which are secured by means of the application of accounting principles. Thus it is axiomatic that the phrases "net profit" and "invested capital" and other similar expressions must bear a very concise meaning if the laws and regulations which are formulated on the assumption that they *do* have well-defined meanings are to be really helpful.

MEANING OF "NET PROFITS."—Yet we find, when we study the development of the problem, that the attempts to define "net profits" have not always resulted in uniformity. Practically all of the states have enacted laws to the effect that dividends must be paid only from net profits, but they have not been so careful as to tell us just what is meant by net profits; whether, for instance, in finding net profits an annual charge for depreciation should be included along with the more obvious expenses. Yet of all expenses this is one of the least avoidable, and net profits cannot be stated until proper allowance has been made for it.

There is little disagreement in framing a definition of net profits in general terms, but trouble arises when we try to discover the detailed deductions that must be made from gross profits to arrive at net profits. Thus an English court declares net profits to be the excess of current gains over the working expenses, as indicated by the revenue accounts;[2] and a New Jersey court says that net profit is the clear gain of a business venture shown after deducting the invested capital, the expenses of operation, and losses sustained.[3] Division of opinion over these statements first occurs when we attempt to detail the actual working expenses, expenses of operation, and losses sustained.

The meaning of these definitions is that capital must not be impaired by declaring dividends out of it under the guise of profits. To say that capital must not be parceled out as dividends and that dividends must be declared out of net profits, is merely viewing the matter from different points. The former expression is used when capital has been deliberately encroached upon, as in *Appleton v. American Malting Co.*,[4] where no question existed as to impairment of capital. The latter expression applies when the bulk of the dividend is proper but in addition to its inclusion of net profits it includes a little capital also.

PRESERVATION OF CAPITAL.—When capital is deliberately distributed through dividends, there is no ground for dispute. The courts are in such close accord as to its illegality and the personal responsibility of the directors for the amount of such illegal dividends authorized, that little need be said about it. But upon approaching the subject from the other side, to learn what reservations must be made in order to insure preservation of the capital, the courts fail to satisfy us with either a clear or a consistent analysis. They point out and punish the gross offense, but they do not show how the evil results which that offense produces may be avoided when those effects result incidentally through the overpayment of dividends and consequent injury to capital. Thus, in the case of *Belfast & M. L. R. Co. v. City of Belfast,*[5] the court asserted that before dividends could be declared, several kinds of charges must be met. The decision runs:

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[2] *In re London, etc., Bank*, 72 L. T. 227; aff'd (1885), 2 Ch. 166.

[3] *Park v. Grant Locomotive Works*, 40 N. J. Eq. 144; 3 Atl. 162.

[4] 54 Atl. Rep. 454 (N. J.).

> Therefore, if there is a bonded, funded, permanent, or standing debt, the interest on it must be reckoned out of net earnings. If there is a floating debt which it is not wise or prudent to place in the form of a funded debt, or to postpone for later payment, that should also be paid. If the financial situation of the company is such as to render it expedient to commence or continue the scheme of a sinking fund for the extinguishment of the company's indebtedness some day or other, an annual contribution out of the net earnings for that purpose would be reasonable. These deductions made from the net earnings, the balance will be the profits of the company distributable among stockholders.

Shall we say that the corporation, after conforming to the court's ruling, stood in no danger of impairing its capital?

This was an early case, yet not without precedent. Since it was decided much progress has been made in the way of classifying and defining the deductions which may properly be made from income in order to arrive at net profits and thus to enable us to formulate an intelligent policy in attempting to preserve invested capital. This progress is due to the untiring efforts of public accountants, to the requirements of bankers who grant credit on the basis of correct financial statements, to the now adequate consideration accorded the subject by the Interstate Commerce Commission and other bodies possessing powers to regulate public utilities, and to the attempt of Congress and the state legislatures to make the laws correspond to correct principles of finance. However, there is still some room for improvement.

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[5] 1 Atl. Rep. 362; 77 Me. 445.

DEPRECIATION.—In an early case [6] the Supreme Court of the United States gave the following definition of net profits:

> Theoretically, the expenses chargeable to earnings include the general expenses of keeping up the organization of the company, and all expenses incurred in operating the works and keeping them in good condition and repair.

This case was a precedent for the Maine court in *Belfast & M. L. R. Co. v. City of Belfast* cited above, and, presumably, shaped that decision to a certain extent. The weakness of the decision is its failure to state in detail what expenses are necessary to keep a railroad in good condition. Did the court mean to include therein all charges now indicated under the three heads, repairs, renewals, and replacements, or did it refer to ordinary repairs only? The same decision is marred by the assertion that it is often better to charge betterments to revenue than to capital, which in itself is sufficient to upset all calculations as to net profits, even in railroad accounting.

DEPRECIATION A PROPER CHARGE.—In the same year that the decision in *Union Pacific R. R. v. United States* was handed down (1878), the Supreme Court in *United States v. Kansas Pacific Railway Co.*,[7] indicated that it limited the charges to gross income to the expenditures actually incurred, refusing to accept as a proper charge to profits a sum indicated as necessary to put the road in proper repair but not actually expended. This case draws a clean line between current repairs on the one hand, and deferred renewals and replacements on the other. It is difficult to understand how, under this ruling, a reserve could be established for replacement, or how any plan of extending the cost of extensive repairs over a series of years could be pursued. In the light of more recent developments it is easy to see the inconsistency in the definition of net profits given by the Supreme Court and in its attempt to apply it. In more recent decisions of the Supreme Court, notably *City of Knoxville v. Water Co.*[8] and *Willcox v. Consolidated Gas Co.*,[9] depreciation is regarded as a proper charge.[10] In the former case the Supreme Court says that a company "is not bound to see its property gradually waste, without making provisions out of earnings for replacement," and adds that it is privileged to keep its property unimpaired by the expenditure of earnings, in order that after a period of years the original value may be still maintained.

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[6] *Union Pacific R. R. v. United States*, 99 U. S. 402 (1878).

[7] 99 U. S. 459.

This brief statement should not be misinterpreted as meaning that the question is now settled. There still rages a vigorous controversy over the question of the necessity of an allowance for so-called theoretical depreciation. There also remain such questions as, what rate to employ, what is the proper method of setting up reserves, and so on. These questions are given attention elsewhere in this book.

Our courts have done little to compel a regular charge to depreciation, their function being the interpretation rather than the formulation of laws. Less conspicuous but more effective have been the efforts of public accountants—both in this country and in England—and also of bankers, to secure adequate depreciation charges. Many corporations now make regular depreciation charges in order to secure an unqualified audit certificate. Much time has been spent in clearing away false conceptions, and we have entered a period in which what at first appeared to be an improper charge, and then a legitimate one, is now regarded as a necessary one. The movement has been considerably aided by the publications of the Interstate Commerce Commission, which present the results of long experience on the part of railway accounting officers and public accountants. The method of charging depreciation employed by the Commission is the outcome of its attempt to aid itself and others in arriving at the facts in railroad administration. In this connection note the following provision of paragraph 5 of the recently amended Interstate Commerce Act:

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[8] 212 U. S. 1 (Jan. 4, 1909).

[9] 212 U. S. 19 (Jan. 4, 1909).

[10] These decisions have as precedent the leading case of *Smyth v. Ames* (1898). For a discussion of this important case see p. 48.

> The Commission shall as soon as practicable prescribe for carriers subject to this act the classes of property for which depreciation charges may properly be included under operating expenses and the percentages of depreciation which shall be charged with respect to each of such classes of property, classifying the carriers as it may deem proper for this purpose.

At the time of writing both the Interstate Commerce Commission and the carriers subject to the provision of the Interstate Commerce Act are engaged in investigations looking to the promulgation as soon as possible of rules and regulations to be observed by carriers in connection with the accrual of depreciation. Objection has been made to such an interpretation of this provision of the statute as will make it necessary for carriers to set up depreciation reserves for so-called theoretical depreciation on the ground that it will make rates unnecessarily high.[11] For a more detailed discussion of this subject see Chapter IV. It is merely mentioned here to show to what extent government control has gone in the matter of prescribing methods of accounting. Many state utility commissions are likewise given authority to prescribe depreciation rates.

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[11] *Depreciation Charges of Railroads and Public Utilities*, a memorandum filed with the depreciation section of the bureau of accounts of the Interstate Commerce Commission, by Robert A. Carter and William L. Ransom.

Regulations of Interstate Commerce Commission

A thorough understanding of the extent and method of control thus exercised will be secured from a study of the following pages which describe the procedure adopted by the Interstate Commerce Commission with reference to gas and electric corporations in the District of Columbia.

GAS AND ELECTRIC COMPANIES.—According to act of Congress, the Interstate Commerce Commission is given power to prescribe uniform accounts for gas and electric corporations in the District of Columbia.[12] According to its published classification,[13] the accounts are divided into three fundamental classes: (1) operating revenue and expense accounts, (2) income accounts, and (3) balance sheet and capital accounts. Under these come the subdivisions, or primary accounts. Thus, for gas corporations operating revenue falls into six distinct accounts, which are designated by symbolic letters with annexed numerals, as G101, G102, and so on. Operating expenses for gas corporations are divided into five general classes: (1) production expenses, (2) transmission and distribution expenses, (3) street and park lighting expenses, (4) commercial expenses, and lastly, (5) general and miscellaneous expenses. Production expenses are separated into seventeen classes, four of which are maintenance accounts for work and station structures, power plant equipment, gas apparatus, and work tools, respectively. Transmission and distribution expenses are separated into nine classes, four of which are maintenance accounts for gas mains and services, gas meters, distribution tools, and gas appliances, respectively. Street and park lighting expenses are separated into two classes, one of which is a maintenance account for street lamps. General miscellaneous expenses are separated into sixteen classes, one of which is a maintenance account for general structure, and a second is an account for general amortization. A similar classification is followed for electric corporations. It is in these maintenance accounts that the depreciation of the different capital accounts is expressed. In this connection it should be noted that the maintenance accounts and capital accounts are complements of each other.

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[12] Effective Jan. 1, 1910.

[13] *Uniform System of Accounts for Gas Corporations and Electric Corporations in the District of Columbia.*

Income accounts form the next general division. There are seventeen classes of these, the account for operating expenses being the one in which the depreciation costs or expenses as expressed in the maintenance and depreciation accounts are collected for deduction from the amount of gross income.

The third general division is composed of the balance sheet accounts. These indicate assets, liabilities, and capital. The asset accounts are twenty-five in number, and the liability and capital accounts fourteen in number. Liability account 37 is entitled "Accrued Amortization of Capital," and is complementary to operating expense account G174, entitled "General Amortization." To General Amortization (G174) an amount is charged monthly necessary to cover wear and tear, obsolescence, and inadequacy accrued during the month in the tangible capital, a reasonable amount for depreciation of intangible capital, and a sufficient amount to cover ordinary casualties, less the amounts charged for repairs in the various maintenance accounts. The amount so charged is in turn credited to liability account 37, Accrued Amortization of Capital, thus:

General Amortization (G174)	$......	
To Accrued Amortization of Capital.		$......
To cover depreciation, inadequacy, wear and tear, loss of intangible values, and extraordinary casualties, not covered in current maintenance for the month ending.....................		

It must be remembered that the reserve for accrued amortization of capital is what its name implies—an account to adjust depreciation not made good through maintenance. The need of such provision was indicated in Chapter III, since, particularly during the first ten or fifteen years of the utility's life, depreciation greatly exceeds maintenance costs. The Interstate Commerce Commission suggests that the corporation's experience during the preceding five years be considered in estimating depreciation. Permission is given to base the rate on the amount of gas sold. Whenever any capital is retired from service, the original money cost, less salvage, is charged to Accrued Amortization of Capital. This is proper, since the reserve has been accumulated to offset the depreciation, which amounts to cost less salvage. In case of property purchased before December 31, 1909, however, the depreciation applicable to the period following that date only, can be charged to Accrued Amortization of Capital. The depreciation accruing before that date should be charged to profit and loss, unless it was actually covered by a depreciation reserve. In the latter case it would be charged to such reserve account.

The plan adopted by the New York Public Service Commission, First District, differs only in detail from the above.[14]

STEAM RAILROADS.—Railroad companies doing interstate business maintain the following general accounts for operating expenses:[15]

1. Maintenance of Way and Structures
2. Maintenance of Equipment
3. Traffic Expenses
4. Transportation Expenses
5. General Expenses

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[14] *Uniform System of Accounts of Street and Electric Railways*, effective Jan. 1, 1909. Also *Uniform System of Accounts for Electrical Corporations*, effective Jan. 1, 1909.

[15] *Classification of Operating Expenses of Steam Roads*, effective July 1, 1914.

Under these general accounts are grouped primary accounts. Included under the general account, Maintenance of Equipment, for instance, are thirty-seven primary operating expense accounts. Each subdivision of equipment—steam locomotives, passenger-train cars, electric equipment of cars, etc.—is given either two or three separate primary maintenance accounts. The Shop machinery is given two accounts: Shop Machinery, to which is charged the cost of repairing machinery and other apparatus, including special foundations, in shops and engine houses, and Shop Machinery—Depreciation, to which is charged all current losses from depreciation of shop machinery. Steam locomotives, on the other hand, are given three accounts: Steam Locomotives—Repairs, Steam Locomotives—Depreciation, and Steam Locomotives—Retirements. The nature of the asset determines whether or not a "retirements" account shall be kept for it.[16] The following from the official classification showing the requirements for passenger-train cars will show how these accounts are to be kept:

> 317. PASSENGER-TRAIN CARS—REPAIRS
>
> This account shall include the cost of repairing passenger-train cars and appurtenances and passenger car features of motor cars used in transportation service; small hand tools used in repairs; the net loss sustained on account of the destruction of foreign passenger-train cars in the carrier's transportation service, and amounts paid others for repairs of passenger-train cars for which the carrier is liable.
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> NOTE A.—The cost of candles, wicks, and lamp chimneys, and of globes and shades for electric and other lights in passenger-train cars shall be charged to account No. 402, "Train Supplies and Expenses."

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[16] The reader will understand, of course, that the complete system of accounts for steam roads is not described above, but mention is made merely of the *operating expenses* and their subdivisions. For a discussion of the complete system he is referred to various manuals of railroad accounting, such, for example, as Hooper's *Railroad Accounting,* and to the publications of the Government Printing Office, Washington, D. C., which describe the system of accounts prescribed for steam roads.

NOTE B.—The cost of repairing passenger-train cars of foreign lines, which are waybilled as freight and have been damaged in transit, shall be charged to account No. 418, "Loss and Damage—Freight," and the cost of repairing passenger-train cars of foreign lines having trackage rights over the carrier's line, when damaged by collision, wreck, or otherwise, for which the carrier is liable, shall be charged to account No. 416, "Damage to Property."

318. PASSENGER-TRAIN CARS—DEPRECIATION

This account shall include uniform monthly charges representing the depreciation of passenger-train cars. These charges shall be based upon the percentage of the original cost (estimated if not known), ledger value, or purchase price of such equipment determined to be equitable from the carrier's experience and best sources of information as to the average current loss from depreciation. A statement of the percentages used by the carrier for computing these charges, together with the estimated life of the equipment upon which such percentages are based, shall be included in its annual report to the Commission.

Depreciation charges with respect to any passenger-train car shall cease when the difference between the ledger value and the estimated scrap value shall have been credited to the accrued depreciation account.

NOTE.—All charges to this account for depreciation of the carrier's equipment shall be concurrently credited to balance-sheet account No. 776, "Accrued Depreciation—Equipment."

319. PASSENGER-TRAIN CARS—RETIREMENTS

This account shall include amounts necessary to adjust the difference between the ledger value (less salvage) of passenger-train cars retired from service and the amount of accrued depreciation charged on account of such retired cars to the date of their retirement.

NOTE.—Passenger-train cars permanently retired from service, but held pending disposition, shall be written out of service and carried in an appropriate suspense account at an equitable valuation.

The thirty-seven accounts under which maintenance of equipment is charged are as follows:

301. Superintendence
302. Shop Machinery
303. Shop Machinery—Depreciation
304. Power Plant Machinery
305. Power Plant Machinery—Depreciation
306. Power Substation Apparatus
307. Power Substation Apparatus—Depreciation
308. Steam Locomotives—Repairs
309. Steam Locomotives—Depreciation
310. Steam Locomotives—Retirements
311. Other Locomotives—Repairs
312. Other Locomotives—Depreciation
313. Other Locomotives—Retirements
314. Freight-Train Cars—Repairs
315. Freight-Train Cars—Depreciation
316. Freight-Train Cars—Retirements
317. Passenger-Train Cars—Repairs
318. Passenger-Train Cars—Depreciation
319. Passenger-Train Cars—Retirements
320. Motor Equipment of Cars—Repairs
321. Motor Equipment of Cars—Depreciation
322. Motor Equipment of Cars—Retirements
323. Floating Equipment—Repairs
324. Floating Equipment—Depreciation
325. Floating Equipment—Retirements
326. Work Equipment—Repairs
327. Work Equipment—Depreciation
328. Work Equipment—Retirements
329. Miscellaneous Equipment—Repairs
330. Miscellaneous Equipment—Depreciation
331. Miscellaneous Equipment—Retirements
332. Injuries to Persons
333. Insurance
334. Stationery and Printing
335. Other Expenses
336. Maintaining Joint Equipment at Terminals—Dr.
337. Maintaining Joint Equipment at Terminals—Cr.

It was for equipment that the Interstate Commerce Commission first required depreciation reserves to be kept, but it did not possess power to prescribe rates of depreciation until the Interstate Commerce Act was amended as described above.[17]

In addition to the maintenance of equipment depreciation accounts described above, formal depreciation accounts are prescribed under the general expense classifications, Maintenance of Way and Structures, but not for the other three general accounts.[18] Thus account 202 is Roadway Maintenance and account 203 is Roadway Depreciation, account 253 is Power Plant Buildings, and account 254 is Power Plant Buildings—Depreciation; and so on.

Before the third revision of operating expenses became effective on July 1, 1907, repairs, renewals, and depreciation had been grouped in one account, Repairs and Renewals. The change was made in the interests of better accounting, but in some quarters the impression gained ground that operating expenses would thereby be increased. This, as the Commission explained, would be the case only where property has not been maintained in the past. The amount charged for depreciation of property, as indicated, is credited to Accrued Depreciation —Road, Accrued Depreciation—Equipment, or to Accrued Depreciation—Miscellaneous Physical Property, according as the depreciation is a road maintenance expense, an equipment maintenance expense, or a miscellaneous physical property maintenance expense. The accrued depreciation accounts are both adjustment and clearing accounts. They are clearing accounts because when an asset is retired its cost, less salvage, is charged to one of these accounts.

The foregoing is illustrated by the following excerpt from the Interstate Commerce Commission's official classification:

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[17] P. 326.

[18] P. 329.

775. Accrued Depreciation—Road

This account shall be credited with amounts charged to Operating Expenses or other accounts to cover the depreciation of fixed improvements, the cost of which is included in account No. 701, "Investment in Road and Equipment," or in account No. 702, "Improvements on Leased Railway Property."

When any fixed property is destroyed, sold, or otherwise retired from service, the amount included in this account with respect to the property retired shall be charged thereto.

776. Accrued Depreciation—Equipment

This account shall be credited with amounts charged to Operating Expenses or other accounts to cover the depreciation of the accounting company's equipment.

When any equipment is destroyed, sold, or otherwise retired from service, the amount included in this account with respect to the property retired shall be charged thereto.

777. Accrued Depreciation—Miscellaneous Physical Property

This account shall be credited with amounts charged to income or other accounts to cover the depreciation of property the cost of which is included in account No. 705, "Miscellaneous Physical Property."

When any miscellaneous physical property is destroyed, sold, or otherwise retired from service, the amount included in this account with respect to the property retired shall be charged hereto.

This is an abandonment of the theory that railroads, owing to their extensive and varied assets, can with safety permit all charges for repairs, renewals, and replacements to be made to current revenue for the year or period in which repairs, renewals, and replacements are made. As a matter of fact physical depreciation to a certain extent, say, 15 or 20 per cent, will occur no matter how varied or extensive the equipment. Such loss in the investment can be guarded against only through depreciation reserves. It is to be noted, however, that there is a difference in the manner of handling such reservations under the plan suggested by the Interstate Commerce Commission, from that sometimes followed.

Two methods of handling depreciation reserves are in vogue—the insurance method and the sinking fund method. Under the sinking fund method a certain percentage of the value of a property is written off each year and accumulated by compound interest, the investments usually being made in outside securities, so that when the time for replacement arrives the fund will be sufficient to purchase the property necessary to make the replacement. This it will do if the cost of the replacement is the same as the original value of the property replaced, or, if greater in value, with an additional expenditure, which will be, not a replacement, but a betterment.

Under the insurance method, which is approved by the Interstate Commerce Commission, compound interest is not used, and the fund is not designated for the replacement of any specific part of capital; nor is the fund accumulated through the depreciation charge reserved until it can be expended in replacing the identical property upon which it was figured. Rather it is spent wholly or partly during the same year in which it is charged, by replacing other equipment or purchasing additional equipment. Of course, the entire accumulation need not be spent during the year in which it is accumulated. Business policy must determine whether replacements or new equipment shall be purchased, the decision lying with the board of directors.

TELEPHONE COMPANIES.—The Interstate Commerce Commission is given power to prescribe the form of accounts to be kept by telephone companies subject to the Act to Regulate Commerce. The system for large companies went into effect January 1, 1913, while that for class C companies (those having annual operating revenues exceeding $10,000 but not over $50,000) became effective January 1, 1915. The system of accounts prescribed for class C companies requires the maintenance of a "Depreciation of Plant and Equipment" account to which is to be charged monthly or annually the estimated amount of depreciation accruing in the plant and equipment. This amount is to be credited to a "Depreciation Reserve" account, against which is charged, to the extent that such charges are covered by the reserve, the expense of reconstruction or the cost or ledger value of property when retired.[19] For the larger companies the requirements are somewhat more detailed.

Regulations of the State Commissions

It is impossible here to enter into a detailed discussion of the work of the state utility and public service commissions. The tendency has been, during the past decade, gradually to widen the scope of their authority and to change their powers from an advisory to a mandatory form. The earlier control was usually limited to a more or less complete supervision of steam railroads, but the jurisdiction of many of the commissions now includes all public utilities. The earliest charters granted to railroads in New York and other states provided for the filing of annual reports and in 1843 the legislature of New York enacted a general railroad law which specified the contents of the reports to be submitted by the railroad companies. Massachusetts, however, was the first state to develop the accounting features of railroad reports. In 1876 the legislature of Massachusetts authorized its board of railroad commissioners to "prescribe a system on which the books and accounts of corporations operating railroads or street railways should be kept in a uniform manner." It also gave the board authority to audit the books of these corporations.

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[19] *Uniform System of Accounts for Telephone Companies, Class C,* effective Jan. 1, 1915.

A few years later Massachusetts established a commission of gas and electricity and endowed it with similar powers of supervision. In 1885 this commission adopted a form of annual report and a classification of accounts for gas companies, and one for electric companies in 1887. In 1905 New York established a commission of gas and electricity with supervisory power over accounts. In 1907 New York and Wisconsin established public service commissions of the strong type, and following their example most of the states have granted full powers of regulation over utilities to their commissions. Ordinarily the filing of annual reports is made mandatory. These become public records and are published in the report of the commission to the legislature.

The results of commission regulation can be of great benefit to investors and consumers only when there is sufficient standardization of accounts and accounting methods to permit just comparisons to be made between companies. In this way only can the investor secure adequate information concerning the affairs of his company, and only thus can a just determination of rates be made.

Standardization of accounting methods cannot be accomplished until uniform rules for accounting for depreciation have been developed. Needless to say, there is still much disagreement as to what are the correct principles for the depreciation accounting of public utilities. Nevertheless much has been done towards developing a scientific procedure concerning it.

The provision for depreciation made by the Interstate Commerce Commission in its classification of operating expenses of steam roads, effective July 1, 1914,[20] appears to have given an impulse to the state commissions to develop similar systematic methods of procedure, and in some cases the accounts prescribed by the Interstate Commerce Commission have been applied by the state commissions with slight alterations. The state commissions have led, however, in the determination of depreciation rates, and many states have enacted laws giving their commissions full power to prescribe rates of depreciation. The Massachusetts law requires gas and electric plants to include among operating expenses a depreciation allowance "equal to 3 per cent of the cost of the plant exclusive of land and any water power appurtenant thereto or such smaller or larger amount as the Board of Gas and Electric Light Commissioners may approve." [21] The rate was reduced from 5 to 3 per cent in 1906. The following is an extract from the report of the New York Committee on Statistics and Accounts of Public Utilities:

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[20] See p. 329.

> The public interest that requires public supervision of accounting of public utilities necessarily requires public determination of rates of depreciation. Experience has demonstrated the necessity of establishing definite requirements for depreciation accounting. The statements of earnings and expenses of individual companies published by the Commissions may easily mislead legislators, citizens and investors, who have assumed that the allowances for depreciation made and reported by the companies themselves have received the approval of the commission. Some companies have grossly inflated expenses by excessive charges for depreciation; other companies have greatly understated expenses and overstated profits by inadequate charges for depreciation. The commissions are therefore urged to ascertain and prescribe depreciation rates for individual companies as soon as possible and until such individual investigations have been completed to require utilities to make depreciation charges at some minimum rate, which may approximate 3 per cent on the entire fixed capital of gas companies and 3½ per cent in the case of electric companies. Such a requirement would secure some degree of uniformity in a field where there now exist practices so diverse as to perplex

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[21] Revised Laws, Ch. 34, as amended, 1908.

and exasperate the public and investors who study the reports of expenses and costs of gas and electricity submitted by the companies and published by the commissions.

Summary of Commission Regulation

Although commission regulation has not been wholly free from abuse it has become firmly established as an integral feature of our plan of state control of public utilities. It has done much to clear up the disputed aspects of the depreciation question, not without working injustice to investors in some instances. The Interstate Commerce Commission has made clear that a charge may be made for repairs or renewals even though it be not all expended within the period covered by the statement of profit and loss. The Commission states that it is not intended to say that the entire accumulation of a year must be expended during the year.[22] This simplifies matters greatly. It makes it possible to write off a developmental expense over a series of years; and it also makes it possible to accumulate a fund for the future replacement of expensive material assets.

Much has been done to establish a compulsory depreciation charge, also to determine the amount of such charge. This is a development of the utmost significance and one which, unless wisely and moderately controlled, may cause great injustice to investors or to the public. Nevertheless it is a fundamentally sound development and the natural and inevitable outgrowth of government regulation.

The alternative of commission control is state ownership, but at present sentiment is decidedly against this. It is the author's belief that the ground has been pretty thoroughly broken already, and that the future will see further refinements and developments of the theories already established rather than many fundamentally new departures.

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[22] *Accounting Series, Circular No. 13,* p. 2.

Control of Private Industry

Recent developments have shown that private industry is not wholly free from the hand of governmental authority. During times of national emergency, such as existed during the World War, the executive department is given vast dictatorial powers, and arbitrarily determines the general course of industry and trade. Under the cost-plus contracts which fixed the terms of manufacture of much of the war supplies purchased by the United States government the rates of depreciation allowed as an element of cost were determined not by the manufacturer but by the government.[23]

The Federal Trade Commission has given attention to cost accounting systems for manufacturers and to accounts for retail merchants and has issued pamphlets treating these subjects.[24] No manufacturer or merchant is compelled to adopt these systems; nevertheless their wide-spread appeal has much indirect influence. They show the need of a certain degree of uniformity in private industry. The income tax and narrow margins of profit emphasize this need. The Commission says that "no merchant can be said to be managing his business properly unless adequate provision is made for depreciation." [25]

The federal income tax has brought us nearer to governmental regulation of accounting methods employed in private industry than has any other agency. As yet the Treasury Department has not attempted to fix rates of depreciation, as has the English Inland Revenue, but it prescribes the general principles to be followed and it disallows depreciation rates if they are excessive. It has, however, suggested rates on certain kinds of property which will be acceptable, and it is quite possible that with the advent of less prosperous years and a greater diffusion of the knowledge of the ways of tax evasion by means of excessive depreciation allowances the Treasury may find it necessary to fix maximum limits after the British fashion.

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[23] See p. 117.

[24] *Fundamentals of a Cost System for Manufacturers,* July 1, 1916. *A System of Accounts for Retail Merchants,* July 15, 1916.

[25] *A System of Accounts for Retail Merchants,* p. 5.

It is possible, too, that the powers of the Federal Trade Commission may be extended to permit it to dictate depreciation methods and rates to private industry. Many surprising developments have occurred since the first edition of this book was published, and if during the next six years such an event should occur it would be no more revolutionary than the changes of the past six years. It is the author's belief, however, that this will not occur, but that this is the legitimate field for the skill of the professional accountant. He is best prepared to advise business men regarding this subject and much will depend upon the results which he secures.

CHAPTER XVII

THE VALUATION PROBLEM

Status of Public Utilities

The valuation of public utilities for purposes of rate-making, purchase, taxation, and capitalization is a corollary of the control of industry by the State. It is axiomatic that if the State has the right to regulate industry it has the right, and it may be its duty, to ascertain the fair value of the properties which it takes under its guardianship. It may be compelled to do so by certain very elementary tenets of justice. Certain fundamental distinctions exist between those industries which are "clothed" with a public interest and ordinary private enterprises, although it must be admitted that the distinction between them is not always clearly drawn. In all such public utility enterprises the interest of the public is involved, usually in a very vital manner, because they are the only sources of the services required and can therefore take some advantage of their monopolistic stronghold. Not, of course, that competition may be wholly absent or that the power of monopoly is one which, even when unhindered by the government, makes possible the unlimited increase of charges.

The past forty years have witnessed great changes in the relation of the State to the utilities. Monopoly is now recognized as a permanent institution and a perpetual problem of statesmanship. In its final analysis it is a problem of economic justice. The rates charged for services can be determined only by taking into consideration all the factors which affect the validity of invested capital and the rights of private property.

Recent Industrial Changes

Fifty years ago many of the modern industrial institutions were either unknown, or so new that their real position in relation to the consumer was not fully appreciated. Transportation facilities were so much needed that franchises, grants, and privileges were given without any great amount of reflection upon the ultimate effect of such action upon the community. However, with the great industrial development of recent years, the growth of cities, the alterations in industrial and commercial methods, and the consequent changes in economic theory in conformity with these newer conditions, it has been found necessary to scan carefully the State's relation to industry, with the result that today the control of public utilities by the State is universally recognized as one of its legitimate functions. This interference finds points of contact in the State's power to tax and to determine an equitable charge for the services which the various public utility corporations render.

Valuation by Commissions

The federal government and many of the states have undertaken the work of valuation of the properties of public service corporations. Much has been done in the way of determining what principles should govern these cases. Much still remains to be done. In some instances so numerous are the precedents that we may assume that the principle has been fully established. In other instances reports and decisions conflict, so that the outcome awaits further elucidation of the matter, or the decision of the United States Supreme Court—or, possibly, both.

Massachusetts took the lead with the formation of a board of railway commissioners and with the organization in 1885 of a gas and electric light commission, while the control of telegraph and telephone companies was placed in the hands of a board of highway commissioners.[1] Corporate capitalization and the issuance of securities have occupied chiefly the attention of the Massachusetts commissioners. Valuation for rate-making was exhaustively made by the Minnesota Railroad and Warehouse Commission, created in 1899, while the Railroad Commission of Texas, organized in 1891, has sought to ascertain the reconstruction value of the railroad bed, track, depots, and transportation facilities belonging to the railroads in the state. In 1907 New York established two public service commissions, having control of railroads, and electric and gas public service utilities. The Public Service Commission for the First District has jurisdiction in Greater New York, while the other has control over the remainder of the state, including telephone companies within New York City. In 1905 Wisconsin placed the control of express companies in the hands of her Railroad Commission, and later placed under its control practically all other public service corporations, thus transforming it into a full-fledged public service commission. These commissions have necessarily been granted the power to make valuations of the utilities which they control.

WORK OF INTERSTATE COMMERCE COMMISSION.—The amendment to the act to regulate commerce made March 1, 1913, provided for a valuation by the Interstate Commerce Commission "of the several classes of property of carriers subject thereto and securing information concerning their stocks, bonds, and other securities." The law required the Commission to report in detail as to each piece of property "the original cost to date, the cost of reproduction new, the cost of reproduction less depreciation, and an analysis of the methods by which these several costs are obtained, and the reasons for their differences, if any."

The Interstate Commerce Commission accordingly organized a valuation bureau which co-operated with the railroad officials and the valuation departments of the railroad companies. The Commission found that there were many economic problems to be solved and that there was lacking an accurate terminology. The Commission found itself confronted by various possibilities of interpretation and procedure. It was required by the law to find original cost to date. "This," says the Commission, "is a fact of prime importance. Every effort is being made to secure this information. The experience of the bureau indicates that in most cases it will be impossible to report original cost to date from accounting records alone." It was also required to ascertain the cost of reproduction new of each piece of property owned by the carrier. "In complying with this requirement," says the Commission, "we have proceeded upon the theory that the property under valuation is nonexistent." It details the manner in which this was accomplished thus:

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[1] See p. 337.

> The engineer making the estimate assumed that the road was not in existence. All other conditions in the territory through which the road runs were taken as they existed on valuation date. The engineer then prepared what he conceived to be the most practicable and economical program for the construction of the road. The items which make up the physical property were then inventoried and cost prices fairly representative of conditions on valuation date were applied. To the figures thus obtained was added the estimated cost of placing the items in position as of valuation date, including certain overhead charges. The result thus arrived at is the cost of reproduction new.

It has been contended that the Supreme Court of the United States in the *Minnesota Rate Cases*[2] condemned the finding of cost of reproduction new by assuming the nonexistence of the railroad while at the same time assuming the existence of cities and other industrial developments along its route. The Supreme Court said:[3]

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[2] 230 U. S. 352.

> Moreover, it is manifest that an attempt to estimate what would be the actual cost of acquiring the right-of-way, if the railroad were not there, is to indulge in mere speculation. The railroad has long been established; to it have been linked the activities of agriculture, industry and trade. Communities have long been dependent upon its service, and their growth and development have been conditioned upon the facilities it has provided. The uses of property in the communities which it serves are to a large degree determined by it. The values of property along its line largely depend upon its existence. It is an integral part of the communal life. The assumption of its nonexistence, and at the same time that the values that rest upon it remain unchanged, is impossible and can not be entertained. The conditions of ownership of the property and the amounts which would have to be paid in acquiring the right-of-way, supposing the railroad to be removed, are wholly beyond reach of any process of rational determination. The cost-of-reproduction method is of service in ascertaining the present value of the plant, when it is reasonably applied and when the cost of reproducing the property may be ascertained with a proper degree of certainty. But it does not justify the acceptance of results which depend upon mere conjecture. . . .

It is the contention of the Interstate Commerce Commission, however, that the Supreme Court in the above citation referred to railway rights of way, yards, and terminals, not to railroad property other than land, because at page 453 the court said:

> . . . The estimates before us, as approved by the master, with his increase of 25 per cent in the case of the Duluth property, must be taken to be estimates of the "railway value" of the land; and whether or not this is conceived of

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[3] At pp. 452 and 455.

> as paid to other owners upon a hypothetical reacquisition of the property is not controlling when we come to the substantial question to be decided.
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> That question is whether, in determining the fair present value of the property of the railroad company as a basis of its charges to the public, it is entitled to a valuation of its right-of-way not only in excess of the amount invested in it, but also in excess of the market value of contiguous and similarly situated property.
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> . . . .
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> Assuming that the company is entitled to a reasonable share in the general prosperity of the communities which it serves, and thus to attribute to its property an increase in value, still the increase so allowed, apart from any improvements it may make, can not properly extend beyond the fair average of the normal market value of land in the vicinity having a similar character. Otherwise we enter the realm of mere conjecture. We therefore hold that it was error to base the estimates of value of the right-of-way, yards and terminals upon the so-called "railway value" of the property. The company would certainly have no ground of complaint if it were allowed a value for these lands equal to the fair average market value of similar land in the vicinity, without additions by the use of multipliers, or otherwise, to cover hypothetical outlays. The allowances made below for a conjectural cost of acquisition and consequential damages must be disapproved; and, in this view, we also think it was error to add to the amount taken as the present value of the lands the further sums, calculated on that value, which were embraced in the items of "engineering, superintendence, legal expenses," "contingencies" and "interest during construction."

The Interstate Commerce Commission contended, furthermore, that in other decisions handed down by the Supreme Court[4] its method of determining cost of reproduction new had not met with disapproval.[5]

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[4] Notably *Cedar Rapids Gas Co. v. Cedar Rapids,* 223 U. S. 655; and *Des Moines Gas Co. v. Des Moines,* 238 U. S. 153.

[5] *Valuation Docket No. 2* (decided July 31, 1918).

This matter has been discussed here at length to show that the problem of valuation is a complicated one and that there are phases of it which are not yet settled. It is impossible here to present a complete discussion of the subject. For this the reader is referred to the various manuals on valuation. But it is necessary to secure a thorough understanding of the various important bases of valuation and their relation to the subject of depreciation.

Meaning of Value

Nothing in the law indicated what interpretation was to be placed on the term "value." Mr. Prouty, director of the valuation bureau, in interpreting the law, concluded that to arrive at "fair values" it would be necessary "to marshal every fact obtainable with respect to the present condition and the past history of our railways." [6] But in addition to the simple concept "value," we have the various complex ones such as "fair" value, "service" value, "exchange" value, "going" value, "market" value, and "physical" value. Ordinarily the economist uses the word "value" in the sense of "exchange" value, but no single abstract concept such as this is an adequate solution to the complicated problem of securing a just valuation for the several purposes for which valuations are made, although we do have the statement of Chairman Stevens of the New York Public Service Commission, Second District, that "value" with reference to taxation, rate-fixing, and capitalization is "value in exchange." [7] But another member of the Commission dissented, saying that for capitalization not "value in exchange" but "the money which has been skillfully and economically invested in the property," is the basis. Moreover, in another case [8] Chairman Stevens said that value in exchange is not the proper basis in a rate case, since it is dependent upon the rate. "To base the rate upon the exchange value would be generally merely to continue the rate, and it would absolutely continue it so far as the value is dependent upon the rate. If the change in rate affects the net income, it changes the exchange value; and if there be no change in exchange value there can be no change in rate."

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[6] Address, Chamber of Commerce of the United States, Feb. 11, 1914.

[7] *Matter of the Application of the Westchester Street Railway Co.,* 3 P. S. C. 2d D. (N. Y.) 286 (Apr. 24, 1912).

[8] *Fuhrmann v. Cataract Power & Conduit Co.,* 3 P. S. C. 2d D. (N. Y.) 656.

Commissioner Eshleman of the California Commission has said that fair value is determined by cost to produce the property, not by earning capacity, but he also says, referring to the decision in *Smyth v. Ames,*[9] that the Supreme Court of the United States did well in not attempting to define "value" and in contenting itself "with pointing out certain elements that should be considered, leaving the determination of the composite fact 'value' to the discretion of the tribunal empowered to act." [10]

COST VERSUS VALUE.—Some writers see no relation between cost and value; others see a very close relation between them and even assume that cost determines value for rate purposes. It does not necessarily follow, of course, that value when determined need be the sole factor in the determination of rates. If railroads are permitted to include the unearned increment in values then cost can no longer be the sole basis for the determination of value. Writing in 1914, B. H. Meyer of the Interstate Commerce Commission said that he thought it "possible to approximate a standard in rate making much more than has been done in this country in the past," also that "the standard which I expect to see develop more rapidly in the future than in the past is a certain approximate standard applicable to normal or typical conditions from which variations will be made in the light of the concrete facts in each particular case."[11] He emphasized the fact that there can be no "rate yard-stick" and did not attempt to formulate the principles which determine value, but apparently advocated the cost theory. If the unearned increment belongs to the state, then we are limited to the cost theory. But while cost is undoubtedly a factor of great importance it is not the only one to be considered.

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[9] See p. 48.

[10] Whitten, R. H., *Valuation of Public Service Corporations,* II, pp. 916, 918.

Possibly the constitutional definition of the value of property as provided for in the fourteenth amendment is satisfied by the cost of property account shown in the balance sheet; but no court will assume that that account represents either fair present value or even money actually invested. Abandonments, improvements, consolidation and reorganizations, the issue of securities at other than their par value, and the various felicities of bookkeeping often make such an assumption unwarranted. Nevertheless, where correct accounting principles have been followed and where the results are accepted only after careful tests of the accounts, the book accounts reflecting cost of property are a very important source of information in the work of valuation.

The impossibility of arriving at a definite determination to use cost as a sole basis of valuation has resulted in the formulation of various valuation theories which represent various modifications of the original cost theory and of the cost of reproduction new theory. Owing to recent price tendencies the former is ordinarily regarded as being too favorable to the public and the latter as being too favorable to the utilities, with the result that the earlier tendency of the courts to emphasize original cost has gradually changed to a cost of reproduction new basis,[12] allowance being made for existing depreciation.

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[11] *American Economic Review Supp.*, Mar., 1914, p. 70.

[12] Recently, however, there has been a tendency to revert to the cost basis, a distinction having been made between those utilities which have a preregulation history and those which have had their origin in the clear light of commission regulation. The reason for this distinction is obvious, since commission regulation has been accompanied by uniformity of reports, supervision of securities issues, regulation of rates, etc., all of which tend to make possible a strictly cost basis of valuation.

This is stated merely as a tendency. In general, it may be said that the courts and commissions, after giving due consideration to general theories of value, are inclined to give increasing weight to local circumstances. These developments will be discussed in the following pages. It may be helpful to bear in mind that three factors of great importance in determining fair value are cost, cost of reproduction, and depreciation.

The Purposes of Valuations

We have found that value is not a simple concept to be determined by unvarying rules under differing circumstances; but that various theories have been formulated to explain and justify the use of widely different conceptions of the word. Some authorities have approved of some single standard of value, such as cost or cost to reproduce new, while the more discriminating have sought to ascertain value by a consideration of several factors.

VALUATION VARIES WITH PURPOSE.—The purpose for which the valuation is made is a matter which must also be given consideration. It is generally conceded that the method of treatment of the intangible elements may very properly depend upon the object of the valuation. A valuation for rate-making or sale may be higher than one for purposes of security issues or taxation. Sometimes it is said that the value of certain kinds of physical property should be excluded in making valuations for purposes of taxation because its cost is a form of tax. Paving is an example.[13] Donated property may be included for purposes of purchase or taxation, but be excluded in fixing rates. On the other hand some items may be included when the company does not possess a legal title to them, as when pavement and piping are altered when a railroad is constructed through a city.

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[13] Nash, L. R., *Valuation of Public Service Properties*, p. 2.

Valuation for Taxation versus Valuation for Rates

As to valuation for purposes of taxation and for rates, Commissioner Wood of the Indiana Railroad Commission says:[14]

> With reference to taxation values in the State of Indiana, we hold that this is not the value upon which the carriers can claim a rate. We hold that they are entitled to earn and to pay to the State whatever assessment is made against them no matter on what method the assessment may be made, and that the amount paid must be allowed to them just as the cost of operation is allowed to them, but on the other hand the taxation value is not the value upon which to base the rate, but the rate must be based upon the amount which they have invested, and not otherwise.

In *Spring Valley Water Co. v. San Francisco,*[15] District Judge Farrington says:

> The argument that the franchise ought to be worth something for rate-fixing purposes if it is worth millions for taxation is not without force. The value fixed by the assessors, however, is not admissible as evidence of value in condemnation proceedings. Lewis on Eminent Domain, No. 448. And such evidence is of little worth here. If the aggregate value of the franchise and physical property as assessed did not exceed the total valuation for water rates, the company suffered no injustice.

In *Willcox v. Consolidated Gas Co.,*[16] the Supreme Court of the United States rejected the company's claim that the tax value of special franchises should control their value for rate purposes.

In *Hill v. Antigo Water Co.,*[17] the Wisconsin Railroad Commission says:

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[14] In the *Matter of Local Merchandise Rates of the Express Companies in the State of Indiana,* No. 495 (Jan. 31, 1912); quoted in Whitten, R. H., I, p. 7.

[15] 165 Fed. 667, 696 (Oct. 7, 1908).

[16] 212 U. S. 19, 51; 29 Sup. Ct. 192; 53 L. ed. 382 (Jan. 4, 1909).

[17] 3 Wis. R. C. R. 623, 728 (Aug. 3, 1909).

> When rates are reduced, the net earnings, together with the values named, are also apt to be reduced. . . . The assessments for taxation are changing with the net earnings or with market values. . . . Since the assessment for taxation thus varies with the rates, it is difficult to see on what just grounds the state should be compelled to use the same valuation for rate-fixing purposes as that upon which taxes are based.
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> . . . .
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> There is no authority for the doctrine that an appraisal for taxation is necessarily a proper valuation for rate purposes. . . . It is needless to say that precedents as to appraisal for tax purposes are of no importance in considering valuations for public purchase, rate making or capitalization.

There are instances, however, in which the valuation for taxation has been accepted for rate-making.[18]

Some authorities think valuations for rates and valuations for purchase are nearly the same.[19] The National Association of Railway Commissioners, however, makes a distinction between them on the ground that a valuation for purchase is final, while in a rate case the thing of importance is the product of the valuation and the rate.

The following cases indicate that value for rates may not be the same as value for condemnation or purchase:

Re gas and electric rates charged by the *Queens Borough Gas & Electric Co.*, 2 P. S. C. 1st D. (N. Y.) (decided June 23, 1911).

Mayhew v. Kings County Lighting Co., 2 P. S. C. 1st D. (N. Y.) (decided Oct. 20, 1911).

Willcox v. Consolidated Gas Co., 212 U. S. 19; 29 Sup. Ct. 192; 53 L. ed. 382 (decided Jan. 4, 1909).

Omaha v. Omaha Water Co., 218 U. S. 180; 30 Sup. Ct. 615; 54 L. ed. 991 (decided May 31, 1910).

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[18] See Whitten, R. H., *Valuation of Public Service Corporations*, I, pp. 10-14.

[19] *Ibid.*, p. 14.

Ames v. Union Pacific Ry. Co., 64 Fed. 165 (decided Nov. 12, 1894).

Spring Valley Water Works v. San Francisco, 192 Fed. 137 (decided Oct. 21, 1911).

Some cases hold value for rate purposes and value for condemnation or purchase to be the same. In *Spring Valley Water Works v. City of San Francisco,*[20] Circuit Judge Morrow refers to a number of leading cases on this matter, including *Monongahela Navigation Co. v. United States,*[21] saying:

> It is true that this was a condemnation proceeding, and the question was to determine what was just compensation for the appropriation of corporate property to a public use, while the case before this court relates to the fixing of water rates which shall be a just compensation for the appropriation of complainant's property to a public use. It is not perceived that there is any difference in the principles applicable to the two cases, and this appears to have been the view of the Supreme Court in *San Diego Water Co. v. San Diego, supra.* (118 Cal. 556), 50 Pac. 633, 38 L. R. A. 460, decided Oct. 9, 1897.[22]

Valuation for Rates and Purchase versus Valuation for Capitalization

There may be a close relation between value for rates and for purchase on the one hand and value for capitalization on the other. This is true when valuation for rates and purchase is based on cost. If, however, value for rates or purchase is based on reproduction cost there is little similarity between them. As nearly as possible cost and value for purposes of capitalization should correspond.

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[20] 124 Fed. 574, 594-595 (decided June 29, 1903).

[21] 148 U. S. 312; 13 Sup. Ct. 622; 37 L. ed. 463 (decided Oct. 9, 1897).

[22] See Bailly, E. C., "The Legal Basis of Rate Regulation," *Columbia Law Review,* June, 1911, p. 334. See also *Regan v. Farmers' Loan & Trust Co.,* 154 U. S. 362; 14 Sup. Ct. 1047; 38 L. ed. 1014 (decided May 26, 1894).

Valuation for Rates versus Valuation for Purchase

In *Fuhrmann v. Cataract Power & Conduit Co.,*[23] it was stated that the difference between value for rates and value for purchase, is that in the former case the question is how much has been put into the property; in the latter how much can be gotten out of it.

> In a rate case the earning power cannot be considered in determining what is the value of the property for the reason that such value depends upon the earning power and the earning power depends again upon the rate, and the rate depends upon the decision which may be made in the case.

In *Public Service Gas Co. v. Board of Public Utility Commissions,*[24] Judge Swayze said:

> The two bases of valuation may properly be different, since upon a sale or condemnation the probability of an assured income and a continuance of the existing rates enters into and affects the exchange value; while in the case of a valuation for the purpose of fixing a rate, the question is what valuation and rate will tempt the investment of capital, and to what extent existing rates may with justice be lowered.

Valuation for Rates versus Valuation for Taxation

That these are not the same is maintained by the United States Supreme Court in the *Missouri Rate Cases.*[25] Also by New Hampshire Public Service Commission:

> . . . for the reason that, in making assessments for purposes of taxation, elements may properly be taken into consideration which are entitled to no weight in fixing a valuation for rate purposes. For example, under the decision of the Supreme Court of New Hampshire in the case

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[23] 3 P. S. C. 2d D. (N. Y.) 656; 18 A. T. & T. Co. Com. L. 1015 (Apr. 2, 1913).

[24] 87 Atl. 651 (July 7, 1913).

[25] 230 U. S. 474; 33 Sup. Ct. 975 (June 16, 1913).

of *Fitchburg R. R. v. Prescott*,[26] it is held that the franchise of a corporation should be included in an assessment for the purposes of taxation. A franchise is a grant from the public, and it would seem clear that it ought not to be made the basis of charges against the public.

The Wisconsin Railroad Commission in *City of Milwaukee v. The Milwaukee Electric Railway & Light Co.*,[27] also said:

> The appraisal value for purposes of taxation may lead to similar erroneous conclusions. Such values are frequently based upon net earnings or the ability of the company to carry a portion of the general burden of taxation and involve a capitalization of net profit even though such profits arise from excessive rates.

From the foregoing it is clear that a valuation is to some extent dependent on the purpose for which it is performed. As has been well said, "value is meaningless unless made with reference to some particular object." In his report to the Massachusetts Joint Board on the validation of the assets and liabilities of the New York, New Haven and Hartford Railroad Company, G. F. Swain said:

> The treatment of depreciation, and of abandoned property in particular, should reasonably differ according to the purpose of the appraisal. . . .
>
> If the object is to justify existing capital, or to serve as a basis for the issue of new securities, or to fix rates of service, it seems reasonably clear, however, that depreciation should not be allowed for.
>
> There is no inherent inconsistency in using one method of valuation for tax purposes and another method for rate purposes. . . . Methods of ad valorem taxation must be worked out with an eye single to what is just and practicable in taxation, and methods of valuation for rate purposes must be worked out with an eye single to what is just and constitutional in rate making.

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[26] 47 N. H. 67.

[27] 11 W. R. C. R. 1; 14 A. T. & T. Co. Com. L. 197 (Aug. 23, 1912).

The preceding quotations are not made because they meet with the author's approval but because they illustrate the most careful thought on the subject. They serve to emphasize the fact that a valuation is always a function of the purpose for which it is made. With these warning considerations in mind we may consider briefly the several main objects of valuations.

Valuations for Rate-Making

This is now recognized as the basis of governmental regulation of utility companies. Nevertheless it was not established without a long struggle in the courts. The question of rate regulation first came before the Supreme Court of the United States in the so-called *Granger Cases* in 1876.[28] In these decisions the acts regulating rates were upheld on the ground that the property was affected with a public interest, that the regulation of rates was a legislative function, and that the courts were powerless to prevent the abuse of this function by the legislature. This doctrine was soon modified and later abandoned. In 1884 Chief Justice Waite suggested a modification[29] of it, and in 1886 he remarked:[30] "It is not inferred that this power of limitation or regulation is itself without limit. This power to regulate is not a power to destroy, and limitation is not the equivalent of confiscation." Yet in 1888 Justice Gray said:[31] "The court has no means, if it would under circumstances have the power, of determining that the rate of three cents a mile fixed by the legislature is unreasonable"; but in 1890 the Supreme Court held[32] that it necessarily rests within the jurisdiction of courts to determine the legality of a rate fixed by a legislature or by a commission. In 1898 it was definitely decided [33] that a "fair return" on the "fair value" of property used in the public service is the chief basis for determining the reasonableness and constitutionality of rates charged. Thus has been developed the problem of fair value and fair rates in which one of the most important considerations is the factor of depreciation.

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[28] *Munn v. Illinois,* 94 U. S. 113; 24 L. ed. 72 (Oct., 1876); and other cases reported in same volume. See also Wyman on *Public Service Corporations,* II, secs. 1427-30.

[29] In *Spring Valley Water Works v. Schottler,* 110 U. S. 347; 4 Sup. Ct. 48; 24 L. ed. 173 (Feb. 4, 1884).

[30] *Railroad Commission Cases,* 116 U. S. 307, 331; 6 Sup. Ct. 334; 29 L. ed. 634 (Jan. 4, 1886). These cases are: *Stone et al v. Farmers' Loan & Trust Co., Stone et al. v. Illinois Central R. R. Co.,* and *Stone et al. v. New Orleans & Northeastern R. R. Co.*

[31] *Dow v. Beidelman,* 125 U. S. 680; 8 Sup. Ct. 1028; 31 L. ed. 841 (Apr. 16, 1888).

[32] *Chicago, Milwaukee & St. Paul Railway v. Minnesota,* 134 U. S. 418; 10 Sup. Ct. 462; 33 L. ed. 970 (Mar. 24, 1890).

In *Smyth v. Ames,* the Supreme Court enumerated six things [34] which should receive consideration in determining fair value. Among these were "original cost of construction," "present as compared with original cost of construction," and the "sum required to meet operating expenses." It also suggested that other factors than the six which it enumerated might deserve consideration. Around the general principles thus enunciated there has been constructed an extensive literature seeking to make the results secured under varying circumstances and conditions conform to the general theory of the fourteenth amendment as thus interpreted.[35]

It is undesirable here to enter into a detailed consideration of the elements of original cost or of present cost of construction. These necessarily vary according to the character of the plant and the manner of its construction. Some items are now recognized as legitimate elements of cost; others are doubtful. Some are subject to obsolescence, inadequacy, and wear and tear, while land and certain engineering costs may not be.

Valuations for Capitalization

Until recently little or no supervision was exercised over the issuance of securities by public service corporations. As a result there were the same instances of inflation and stock watering that existed among the less conservatively managed private corporations. Investors were at a loss to know what was the actual equity behind their holdings and frauds were often perpetrated upon persons ignorant of the true status of affairs. The control of security issues has been an outgrowth of the control of rates and earnings and it would appear to follow as a corollary proposition that if a public service commission is to have the power to determine upon what valuation a company shall earn a fair return it ought also to have the power to determine the nature and amount of the securities issued by that company.

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[33] *Smyth v. Ames,* 169 U. S. 466; 18 Sup. Ct. 418; 42 L. ed. 819 (Mar. 7, 1898).

[34] See p. 48.

[35] Thus the Interstate Commerce Commission in its valuation made under the amendment passed by Congress, March 1, 1913, finds original cost to date, cost of reproduction new, and cost of reproduction less depreciation. Professor H. C. Adams maintains that valuations are made necessary by the fourteenth amendment. (*American Economic Association Quarterly,* Apr., 1910, p. 184.)

As a result certain fundamental principles governing security issues have been developed. In general a public utility company is not permitted to issue securities to obtain funds for the construction of facilities which are not needed or which will duplicate facilities already in existence. If a sale of securities is deemed needful, then the discount, if any, at which they are sold and the manner in which the funds secured from their sale are to be expended are prescribed. Occasionally an issue of securities for financing renewals or replacements is permitted, but usually the issuance of new securities is limited to the financing of betterments. Sometimes, too, property no longer in existence is made the basis of capital issues, providing such property has been abandoned as the result of obsolescence or inadequacy.

It is apparent that valuations made for purposes of capitalization and the issuance of securities is bound up very closely with the questions of obsolescence and depreciation, and that if public service commissions are to have adequate control over security issues they must also have control over depreciation rates and the policy to be pursued in accounting for obsolescence and inadequacy. This was why the Public Service Commission of New York, First District, ordered the New

York Railways Company to reserve 20 per cent of its operating revenues for maintenance and to reserve for depreciation what was not required for repairs and current upkeep. Its predecessor, the Metropolitan Street Railway Company, had collapsed largely because of failure to maintain its property out of earnings. Renewals had been financed successively by means of bond issues which were so pyramided that they placed a great and disproportionate burden of fixed charges upon the company. It was to avoid this condition of affairs that this order was issued. In this instance the New York Court of Appeals reversed the decision of the lower court on the grounds not of unreasonableness but because the law did not expressly grant to the Public Service Commission the control of the financial policies of the utilities. It has been argued that since the law empowered the Commission to prescribe uniform accounts it is to be inferred that it has the power to prescribe depreciation rates. The natural solution of the problem is legislation which specifically grants the power of determining rates to the public service commissions, as has been done in many states and by Congress for the Interstate Commerce Commission. The relationship of this discussion to the subject of capitalization and to the protection of investments is obvious.

Various valuation bases have been employed in valuation for capitalization. These are discussed under the general topic of valuation bases.[36]

Valuations for Taxation

Taxes are essential to the existence of government and should be equitably borne by the property whose existence is made possible and perpetuated by the protective agency of the State. Assessments and valuations are made to enable the State to levy taxes, which are just in proportion to the State's ability to determine the equitable basis of computation. The problem is always difficult because of the difficulty of judging property values, both tangible and intangible. The work of valuing public service utilities is peculiarly difficult because of the complex character of their physical makeup, the difficulty of accounting for intangible values and of giving due weight to depreciation, the unearned increment in increasing land values, etc.

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[36] See Chapters XVIII-XX.

The advent of the income tax and the great increase in rates resulting from the war have made the problem one of even greater importance than formerly. In levying the excess profits tax the problem of valuation has been greatly simplified by limiting the basis for reckoning profits to the actual investment. Many states still retain the general property tax, however, and valuation for purposes of taxation is necessary in case both of utilities and of private industry.

In general the rules which govern tax valuations depend upon the tax laws. Fundamentally such a valuation must be a valuation of real estate, a capitalization of net earnings which is equivalent to a going-concern valuation, or else a franchise valuation made to determine the amount of a franchise tax.[37]

In Texas a valuation was made of the physical property of railroads for taxation purposes, but the Supreme Court of the United States declared that the results could not be used for rate-making because the basis of valuation was too narrow to comprehend all the elements of value.

It is often admitted that tax values of physical property ought to be stated below capitalization values, to prevent overtaxation of tangible property; it was disclosed that St. Paul tax values equal about 60 per cent of normal selling prices.[38] One public service commission states that its findings for capitalization purposes are not intended for rate-making purposes.[39] A corporation may perhaps hold assets for speculation, but not employ them in providing its customary services to the public. Consequently the corporation may not be justified in including such property with that upon which it bases its rates, although it ought to pay taxes on it.

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[37] Floy, H., *Valuation of Public Utility Properties*, p. 8.

[38] Supplement to the Annual Report of the Railroad and Warehouse Commission of Minnesota, Nov. 30, 1908, p. 16.

In 1900 in Michigan a valuation of railroads was made for taxation purposes. Reliance was placed upon the estimates of special appraisers and real estate experts. To cover the special value attaching to the railroad lands an increment was added to the results secured by the experts. This practice of applying "multiples" to railroad property has since been followed frequently. Wisconsin made its valuation for tax purposes in 1903. In 1911 New Jersey made a valuation of its railroads for tax purposes, reliance being placed largely upon the assessed values of adjoining lands. To this 7 per cent was added to represent administrative cost and interest, but the state board doubled the values determined by the expert in making its final estimate of right of way values.

Valuations for Purchase

A utility property may be sold to a city or to another corporation. Such a sale may require a valuation to be made to determine the purchase price. Sometimes utilities operate under franchises which provide for sale to the municipality at the expiration of a given period and under terms which may require a valuation to be made of the plant. The franchise itself is sometimes an item in a valuation, and ordinarily in such cases its cost only is an allowable item in the valuation.

The commissions and courts have attempted to evolve the principles which should govern such valuations. Thus the Wisconsin Railroad Commission usually includes the value of pavement over mains, although it excludes it for rate purposes.

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[39] *P. S. C. R.* (1st Dist., N. Y.), *re Reorganization of Metropolitan Street Railway Co., Case No. 1305.*

But in one case this Commission said: "No allowance will be made for paving which the company was not compelled to remove when laying its mains and services." [40] The Supreme Judicial Court of Maine, in a municipal purchase case,[41] said that "a fair rate—usually the prevailing rate—of interest upon the money invested in the plant during construction, and before completion, is as much a part of the cost of construction, as is the money itself which is expended for materials and labor."

In valuations for condemnation or sale the amount determined is final; therefore care must be exercised that the interests of the parties concerned are not prejudiced. When the sale is to another corporation higher rates should not result.[42]

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[40] Whitten, R. H., *Valuation of Public Service Corporations,* II, p. 986.

[41] *Brunswick & T. Water District v. Maine Water Co.,* 99 Me. 371 (Dec. 14, 1904).

[42] For further consideration see the discussion at p. 389.

CHAPTER XVIII

THE BASES OF VALUATION—ACTUAL COST

General Remarks

As the outcome of the laws passed by Congress and the state legislatures, of the work of commissions in enforcing them, and of the work of courts in interpreting them and reviewing the work of the commissions, certain more or less well-defined bases of determining value of property for rate-making, taxation, purchase, and capitalization have been established. As is emphasized elsewhere, no individual basis may be accepted as the sole criterion of a valuation in a given instance; nevertheless, for a constructive study of the field it is well to make the approach by first studying the various bases which have received consideration by courts and commissions.

It is well to bear in mind that these various bases have been formulated for the purpose of protecting property under the federal constitution. They represent more or less refined attempts to interpret the expressions, "fair value" and "fair return," which the Supreme Court in 1898, in *Smyth v. Ames,* laid down as the factors of vital importance to be considered in determining whether or not private property is being confiscated. The bases or factors of value which were mentioned as being worthy of consideration in that case are enumerated elsewhere.[1] In 1899 the Supreme Court said [2] that a company is entitled to a "fair return upon the reasonable value of the property at the time it is being used for the public." This shows little or no advance in fixing upon a valuation base, but probably represents a tendency toward the adoption of replacement cost. In the second San Diego Land Company decision, in 1903,[3] some integration is noticeable. The court clearly rejected actual cost in favor of replacement cost. It also held that the public may not be required to yield a return on investments injudiciously made, but only on those "reasonably necessary for the existing public service." In 1904 the Supreme Court held [4] that a return of 6 per cent upon the "then value of the property actually used" was not confiscation "nor a denial of the equal protection of the laws," and added that "the original cost may have been too great; mistakes of construction, even though honest, may have been made, which necessarily enhanced the cost; more property may have been acquired than necessary or needful for the purpose intended."

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[1] See p. 48.

[2] *San Diego Land & Town Co. v. National City,* 174 U. S. 739; 19 Sup. Ct. 804; 43 L. ed. 1154 (May 22, 1899).

In 1909 the Supreme Court stated [5] that appreciation may be included in fair value. It included the replacement cost of real estate, and subordinated actual investment as a consideration in determining fair value. Goodwill and franchise value were disallowed. In the same year the Iowa Supreme Court said [6] that the controlling factor in determining fair value is reproduction cost less depreciation. It specifically rejected "cost alone," also "cost to replace alone, for this, in view of its use, would involve mere estimates of depreciation and contingencies incident to construction." A valuation was fixed upon which considerably exceeded cost. This decision was affirmed by the Supreme Court of the United States in 1912.[7] In 1909 the Supreme Court recognized depreciation in the *Knoxville Water Case*.[8] In 1911 the Supreme Court of Oklahoma[9] made reproduction cost less depreciation the controlling factor, but recognized no "inflexible method." It stated that original cost less depreciation may sometimes be fair. In the same year the Wisconsin Railroad Commission said:[10]

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[3] *San Diego Land & Town Co. v. Jasper*, 189 U. S. 439; 23 Sup. Ct. 571; 47 L. ed. 892 (Apr. 6, 1903).

[4] *Stanislaus County v. San Joaquin & King's River Canal and Irrigation Co.*, 192 U. S. 201; 26 Sup. Ct. 241; 48 L. ed. 406 (Jan. 18, 1904).

[5] *Willcox v. Consolidated Gas Co.*, 212 U. S. 19; 29 Sup. Ct. 192; 53 L. ed. 382 (Jan. 4, 1909).

[6] *Cedar Rapids Gas Light Co. v. Cedar Rapids*, 144 Iowa 426; 120 N. W. 966, 968 (May 4, 1909).

[7] 223 U. S. 670 (Mar. 11, 1912).

[8] 212 U. S. 1 (Jan. 4, 1919), same date as decision in the *Consolidated Gas Case*.

> In determining the value of the physical property of a public utility several elements must be taken into consideration. The three elements of greatest importance in fixing the value of such plants are the original cost, the cost of reproducing the plant, and the present value. As to which of these elements shall be given the greatest consideration, must depend upon circumstances in each case and must also depend upon the purpose for which valuation is made.

Also in the same year District Judge Farrington said:[11]

> Cost of reproduction is not a fair measure of value, unless a proper allowance is made for depreciation, because all constructive portions of the plant are subject to decay, and to be worn out or consumed by use. . . .
>
> Original cost is not always a fair criterion of present value, because the plant may have cost too much, or it may be of unnecessary dimensions. If it has increased in value since its acquisition, the company is entitled to the benefit of such increase, if such increased valuation does not require a return so large as to be unreasonable and unjust to the public. . . .

He also rejected market price of securities as an index of plant value, and said, further:

> The most important fact to be determined is the value of the property. The value to be ascertained is the value at the time of the inquiry. Only that property is to be considered which was then used and useful in supplying San Francisco with water. Among the proper matters to be considered are the original cost of construction; the amount expended in permanent improvements; the amount

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[9] *Pioneer Telephone & Telegraph Co. v. Westenhaver,* 118 Pac. 354 (Jan. 10, 1911).

[10] *In re Manitowoc Water Works Co.,* 7 W. R. C. R. 71, 74 (June 27, 1911).

[11] *Spring Valley Water Works v. San Francisco,* 192 Fed. 137 (Oct. 21, 1911).

> and market value of stock and bonds; the present, as compared with original, cost of construction; the probable earning capacity of the property under the particular rates prescribed by the ordinance for each of the years in question; the sums required to meet operating expenses; what it will cost to obtain water, equal in quantity and quality to the present supply, from the next most available source; the depreciation suffered by that portion of the plant which is worn by use or action of the elements, or shorn of its value by newer, cheaper, and more efficient appliances and machinery; the fact that the plant has a franchise and is a going concern, with an established business and thousands of customers, whose buildings are connected with the distributing system; and appreciation in value since the various properties constituting the plant were acquired. To each of these factors just and proper weight must be given; and, finally, the result must be the reasonable and fair value of the plant as between the company and the public.

In the *Minnesota Rate Cases,*[12] 1913, an elaborate investigation of facts was made, but no formal rule of valuation was applied. The equivalence of wear and tear and appreciation caused the master to disregard depreciation, a stand which the court rejected. The cost basis was definitely rejected.

The foregoing review of the early decisions on valuations shows clearly that the development of standards of procedure was a slow and uncertain process. Nevertheless certain more or less definite concepts or rules for the determination of fair present value had been considered, accepted, rejected, or employed conditionally. Aside from those factors which may deserve consideration but which are not usually permitted to have great weight in determining value, such, for example, as the market and par value of stocks and bonds, there are three bases [13] or standards of valuation each of which have been advocated as the sole criterion of present value in given instances or at least has been permitted to influence greatly the final valuation. These three bases of valuation will be considered, with reference to the several purposes for which valuations are made.

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[12] *Simpson v. Shepard, etc.,* 230 U. S. 352.

[13] Reproduction cost less depreciation is regarded as a corollary of reproduction cost new, so that the three bases are original cost, reproduction cost, and market value.

Actual Cost

Actual cost will be considered as a base of valuations for rate-making, capitalization, taxation, and purchase.

RATE-MAKING.—At the outset we meet with difficulties of definition. The term may be used to designate total cost to date regardless of whether all units purchased are in existence today, or it may mean merely the original cost of existing units. Its intelligent use, moreover, is inextricably involved with the correct distinction between capital and income. If accounting records were kept without error, their "book value" might be the best indication of what actual cost is; but "book value" is a notoriously undependable guide in many cases. The discrepancy between cost and present value is frequently so great that actual cost has not secured a strong hold upon the legal mind. The tendency, until recently, has been to include in fair value the accretions arising from natural community growth as well as those received in the form of donations. Probably land gives rise to the most noticeable discrepancies between cost and value where value is synonymous with present market value or replacement value. In 1900 the real estate of the Illinois Central, book value $200,000, was valued at $34,000,000.[14] Nevertheless some authorities uphold the doctrine of original cost.

In 1894 the United States Supreme Court found actual cost greater than reproduction cost, but held that this "actual investment . . . is not to be ignored, even though such sum is far in excess of the present value." [15] Actual cost was strongly upheld in *San Diego Water Co. v. City of San Diego*,[16] in 1897; also in the same year in the Pennsylvania case, *Brymer v. Butler Water Co.*;[17] also in *San José v. Pacific Telephone & Telegraph Co.*[18] The Wisconsin Railroad Commission holds no single standard, but always considers actual cost data when available. In 1910 it said:[19] "For rate-making purposes the actual total investment in the enterprise, subject to certain qualifications, seems to be the basis for determining the reasonableness of the charges that may be exacted of the public."

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[14] Ripley, W. J., *Railroads*, II, p. 351.

[15] *Ames v. Union Pacific Railway*, 64 Fed. 165 (Nov. 12, 1894).

The New York law requires the Commission, in fixing charges on gas and electricity, to "give due regard among other things to a reasonable average return upon capital actually expended." The Interstate Commerce Commission, in *Advances in Rates*, western case,[20] 1911, said that the nearest approximation to a fair standard is the "bona fide investment." The New Hampshire Public Service Commission says that "a rule equitable alike to investors and the public would seem to be that property dedicated to the public use shall neither increase nor decrease by reason of any change in its cost of reproduction, but shall continue to earn a full return upon the amount honestly invested therein." However, in the *Minnesota Rate Cases*,[21] Justice Hughes said: "It is clear that in ascertaining the present value we are not limited to the consideration of the amount of the actual investment," etc. "The property is held in private ownership and it is that property, and not the original cost of it."

Many more cases might be cited for and against, but needlessly. If original cost is to be considered, how does the consideration of depreciation enter? Depreciation reserves are almost invariably set up upon a cost basis. They represent the withholding of replacement funds from income before they are required to make replacements. If these are invested in extensions and betterments, as is usually done, then the property account is increased and its earning capacity likewise. Sometimes earnings have been sufficient but reserves have not been set up. These conditions require the application of a knowledge of accounts if the interests of all parties are to be protected.[22]

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[16] 118 Cal. 556; 50 Pac. 633 (Oct. 9, 1897).

[17] 179 Pa. 231; 36 Atl. 249 (Jan. 4, 1897).

[18] Whitten, R. H., *Valuation of Public Service Corporations*, II, pp. 973-75.

[19] *City of Appleton v. Appleton Water Works Co.*, 5 W. R. C. R. 215 (May 14, 1910).

[20] 20 *I. C. C. R.* 307 (Feb. 22, 1911).

[21] 230 U. S. 352.

It has been decided in the federal courts that where properties are unable to set up reserves to amortize the cost of worn-out equipment they may retain it in "fair value" until increased earnings permit writing it off.[23] The Interstate Commerce Commission has followed this practice. The practice of the state commissions has not been uniform, however. The best reasoned of their decisions allow the inclusion of unearned depreciation in fair value. The Wisconsin Commission, for example, has usually included unearned depreciation and other losses in determining fair value so long as the result secured does not exceed cost of reproduction of property.[24] Since so many companies have been unable to earn depreciation, this policy amounts practically to the adoption of a standard of valuation which does not deduct depreciation in arriving at fair value. Since the depreciated value of well-financed utilities is from 75 to 85 per cent of cost of reproduction [25] the significance of the above from the point of view of the constitutional prohibition of confiscation of property is evident.

CAPITALIZATION.—The connection between cost and capitalization is obvious, yet great discrepancies sometimes exist between them owing to popular methods of promotion and finance. The issuance of common stock as a bonus to purchasers of preferred stocks or other major securities has led to many cases of gross overcapitalization. Sometimes, of course, these inequalities between cost and capitalization have been ironed out through the policy of charging development costs and betterments to income.

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[22] See Chapter XXI for a further consideration of depreciation reserves in valuations.

[23] *Milwaukee El. Ry. & Lt. Co. v. Milwaukee*, 87 Fed. 577 (May 31, 1898). Also *Ames v. Union Pacific Ry.*, 64 Fed. 165.

[24] *Hill v. Antigo Water Co.*, 3 W. R. C. R. 623 (Aug. 3, 1909).

[25] Nash, L. R., *Valuation of Public Service Properties*, p. 17.

Many commissions have been granted supervision of the security issues of the utilities within their jurisdiction and in connection with their work of supervision they frequently find it necessary to make valuations of existing property. Massachusetts was the first state to undertake systematic control of the security issues of public service corporations. In general it has been the policy of Massachusetts to permit the issue of stock of public service corporations for cash only and not below par value. No doubt this policy was largely responsible for the fact that in 1902 the capitalization per mile of street railways in Massachusetts was less than half that of street railways throughout the country. Restrictions are also placed upon the debt-incurring powers of corporations.

The Wisconsin Commission has always placed great emphasis on physical valuation as a factor in determining fair value for rates, but it has not exercised as strict supervision over capitalization as has the Massachusetts Commission. The relationship between valuation for rate purposes and for capitalization purposes is presumably made to protect investors; yet this is not accomplished unless the valuation is at the same time made a basis upon which rates are determined. Securities are worthless unless reasonable rates are earned upon the values which support them; indeed, unless rates are earned, the values are non-existent irrespective of the par value of outstanding securities. The logical procedure is to determine values for capitalization purposes and then base rates on those values. In such a plan the problem of depreciation must be considered, both in the original valuation when values are fixed as a starting point for future operations and as a continuing circumstance after such valuation has been made.

In case of long-established companies the difficulties in the way of making actual cost the basis for capitalization are the same as those in the way of making it a basis for rates. Increased values resulting from normal community growth—the unearned increment—the complications arising when we attempt to reconstruct the property account correctly from the accounting records—the depreciated condition of the plant—these and other questions arise. In case of controlled utilities which operate under a prescribed system of accounts, especially where it is made possible for them to earn their depreciation, the problem is much simpler. Here, due allowance being made for money unwisely spent and for mismanagement, actual cost is perhaps the best basis for both rates and capitalization.

It does not necessarily follow that the approval of an issue of securities by a commission is to be considered as a guaranty of a fair rate of income. In Massachusetts, however, the rates are based upon the securities which the Gas and Electric Light Commission authorizes, and this would appear to be the logical consequence of complete control. Many state commissions, however, base rates upon reproductive value less earned depreciation, although they do have power to control security issues. Here is a discrepancy, and the ultimate outcome will be that the commissions in such states will not undertake to guarantee the securities or else they will compel an adjustment to bring physical value and capitalization into agreement. In the *Consolidated Gas Case* the Supreme Court of the United States refused to permit the lowering of rates below a point which assured a fair return on securities authorized by the legislature of the state. Should the principle that capitalization determines rates be accepted it will mean the acceptance of actual cost as the rate base for all companies organized after the advent of commission regulation. In such case the depreciation problem will hinge upon whether or not depreciation is earned. The presumption is that it will be. Nothing is here said to support the validation of stocks and bonds without first ascertaining the propriety of their issue and the value of the property which sustains them.

In the *Metropolitan Reorganization Case*[26] the valuation was for capitalization purposes. Here obsolescence or supersession as one phase of depreciation was considered, and the folly of retaining obsolete or obsolescent property at original cost figures was shown. Within a period of twenty years many miles of track, once constituting the most valuable lines, had fallen into disuse. One constituent company with outstanding bonds amounting to $1,000,000 par value could neither sell nor lease its track, nor get money to carry on operations. Obsolescence was well illustrated by the inefficiency of the horse car lines. These lines constructed eighteen years before valuation were said to have seventeen years of service remaining, although the system was in fact obsolete and impractical. According to testimony, a certain sum set aside or expended annually would furnish renewals indefinitely and keep up the old horse car system. But merely making provision for the upkeep of an old horse car road was in this instance not considered good business policy.

Failure to make provision for future replacement of existing equipment by more up-to-date equipment necessitated the issue of new securities for the purchase of electric equipment, and this resulted in overcapitalization. Values once amounting to many millions of dollars had ceased to exist. The company held that these values should not be written off because allowance had been made for developmental expenditures in certain rate cases, although no visible evidence thereof remained. But this was not a rate case. The question was, to what extent should securities be amortized; and the Commission rightly contended that securities held for property now non-existent should be amortized.[27] Nor is it probable that such non-existent values would have been granted a place as developmental expenditures in a rate case.

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[26] P. S. C. R. (1st Dist. N. Y.), Case No. 1305.

Taxation.—The basis of valuation for tax purposes will ordinarily depend upon the tax laws. Usually actual cost is not made the basis. Even franchises, which are usually valued at cost for rate purposes, are, for tax purposes, ordinarily valued by the net earnings rule. Yet in a tax case [28] it has been said that "property can have but one true value, whatever may be the purpose of the investigation." But such a statement will not stand. Some property which is properly included in determining tax value ought not to be excluded in determining value for rates, because it is not "used and useful."

Purchase.—Actual cost with or without a deduction for existing depreciation has sometimes been made the basis of valuation for public purchase, but is not usually the controlling factor and is frequently regarded as of little importance.[29] It may be stated as a general rule that for purposes of public purchase depreciation must be considered, but it has usually been deducted, not from original cost, but from cost new, i.e., cost of reproduction. Where franchise value or going concern value is a consideration and is determined on the basis of earnings the actual cost basis is necessarily abandoned. In Maine, under an act authorizing the acquisition by eminent domain of "the entire plant, property and franchises, right and privileges" held by a water company, the Supreme Judicial Court of Maine in issuing instructions to the appraisers laid down the rule that: [30]

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[27] P. S. C. R. (1st Dist. N. Y.), Case No. 1305, p. 159.

[28] *State ex rel. Bee Building Co. v. Savage*, 65 Neb. 714; 91 N. W. 716 (Sept. 18, 1902).

[29] *Town of Falmouth v. Falmouth Water Co.* (180 Mass. 325; 62 N. E. 255, Jan. 3, 1902) involved a valuation in which a statute gave the town the right to take over the plant upon payment of cost and interest. The court decided that actual cost in this case included contractor's profit.

> In determining the present value of the company's plant, the actual construction cost thereof, with proper allowances for depreciation, is legal and competent evidence, but it is not conclusive or controlling.

The same court in a later case,[31] issuing rules for a similar purpose, said:

> While actual cost bears upon reasonableness of rates, and as well upon the present value of the structure as such, in estimating structure value, prior cost is not the only criterion of present value. If, by the rise of prices, the present value of the structure is greater than the cost, the owner is entitled to the benefit of it; if less than the cost, the owner must lose it. And the same factors should be considered in estimating the reasonableness of rates.

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[30] *Kennebec Water Dist. v. City of Waterville*, 97 Me. 185; 56 Atl. 6 (Dec. 27, 1902).

[31] *Brunswick & Topsham Water Dist. v. Maine Water Co.*, 99 Me. 371; 59 Atl. 537 (Dec. 14, 1904).

CHAPTER XIX

THE BASES OF VALUATION—REPRODUCTION COST

General Remarks

By "reproduction cost" is meant the cost of reproducing a property new on the basis of current prices. For this purpose, however, it is usually customary to average prices over a period of years, say five years preceding the date as of which the valuation is made. The plant is usually assumed to be reconstructed from materials and equipment in every respect the same as that used in the construction of the actual plant. Sometimes, however, a substitute plant of equal capacity is assumed. Either present or original conditions may be assumed. Ordinarily it seems fairest to assume reproduction under conditions which actually existed at the time the plant was constructed. Reproduction cost may be either greater or less than actual cost, depending upon price tendencies and upon the skill employed in erecting existing plant. The difficulties which lie in the way of its equitable application are evident and have been well expressed by the Supreme Court of the United States in the *Minnesota Rate Cases:*[1]

> Moreover, it is manifest that an attempt to estimate what would be the actual cost of acquiring the right of way if the railroad were not there is to indulge in mere speculation. The railroad has long been established; to it have been linked the activities of agriculture, industry and trade. Communities have long been dependent upon its service, and their growth and development have been conditioned upon the facilities it has provided. The uses of property

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[1] *Shepard v. Northern Pacific,* 184 Fed. 765.

> in the communities which it serves are to a large degree determined by it. The values of property along its line largely depend upon its existence. It is an integral part of the communal life. The assumption of its non-existence, and at the same time that the values that rest upon it remain unchanged, is impossible and cannot be entertained.

A careful reading of other cases indicates the unsatisfactoriness of the method. It is practically impossible, in many instances, to secure satisfactory estimates, even from experienced engineers. Nevertheless in its various forms it has been very extensively employed. The depreciated condition of many properties has made it necessary in arriving at present value or fair value, to make deductions from reproduction cost for depreciation, so that reproduction cost less depreciation has become a corollary proposition. In *San Jose v. Pacific Telephone & Telegraph Co.*,[2] Commissioner Thelen of the California Commission says:

> Cost of reproduction of a property is to be considered merely because it serves as an indication of what has been invested in the property, and not what the property is worth, as worth is generally understood.

Thus considered, reproduction cost becomes but one of perhaps several criteria of actual fair value.

Reproduction Cost—Rate-Making

Cost of reproduction new as a basis for rate-making has been and is still held to be the true basis upon which to determine rates. Those who uphold this method assert that a distinction must be made between the efficiency of a utility and its value when determined for purposes of sale; that so long as the service performed is equally good as when the utility was new, it is immaterial to the consumer what the extent of the depreciation amounts to.

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[2] Whitten, R. H., *Valuation of Public Service Corporations*, II, p. 973.

That depreciation ordinarily bears little or no relation to efficiency is shown in Chapter III. Depreciation means that the time of replacement is approaching, and consequently the total service value of the thing depreciated is less than when new. But its efficiency remains unimpaired, and sometimes even increases as the result of adaptation and adjustment.

AUTHORITIES NOTED.—One of the advocates of the cost-to-reproduce basis is A. C. Humphreys, president of the Stevens Institute of Technology.[3] As an illustration he takes the ties of a railroad or the poles of a telegraph line. Assuming that these have an average life of ten years, and that one-tenth of the total number should be replaced each year, Mr. Humphreys says that it is maintained by some that the average age of the ties or poles taken together is five years, and that therefore 50 per cent depreciation should be deducted from cost of reproduction to determine the proper basis for rates. Mr. Humphreys says that while such a statement may be correct as a question of averages, it is entirely without warrant as a basis for the deduction of 50 per cent from the investment. Such a procedure, he says, is confiscation, depriving the investor of a return on one-half of his investment. Rather, the only thing which the customer is concerned with is the efficiency of the service afforded, and if this is kept at 100 per cent there can be no reason for reducing rates.

Mr. Humphreys further suggests that if a deduction must be made from original cost to cover depreciation such as cannot be avoided by adequate renewals, then an amount equivalent to such deduction ought to be added to the appraisal as an item of cost, just as interest during construction and other items of intangible character are included.

The reproduction-cost-less-depreciation theory has been upheld by the following:

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[3] *Depreciation: Estimated and Actual; Proceedings of the American Gas Institute,* VIII, Part II, p. 521.

Oklahoma Supreme Court in *re Pioneer Telephone & Telegraph Co. v. Westenhaver* (Jan. 10, 1911).

New York Public Service Commission, First District, in *re Metropolitan Street Railway Reorganization* (Feb. 27, 1912).

The Supreme Court of the United States.[4]

Robert H. Whitten in *Valuation of Public Service Corporations* (1912), Vol. I, p. 359.

The Special Committee of the American Society of Civil Engineers in their tentative report on *Valuation for the Purpose of Rate-Making*.[5]

With reference to the statements made by the advocates of the reproduction-cost-new theory, the above-mentioned committee observes that these writers invariably ignore the fact that a depreciation allowance is a return of a part of the investment, and that when the investment is thus returned it does not constitute confiscation to make depreciated value the basis for rates. Nor, says this committee, do the rates necessarily decrease when depreciated value is made the basis. Although it is true that in case of a given property the amount applicable to dividends grows less as the property grows older, this is altogether proper; for a continually increasing amount of the investment has been returned to the investors, and has been used in making replacements and additions, or perhaps is temporarily placed in a depreciation fund, with the result that the entire original investment remains intact at all times.

REPRODUCTION COST LESS DEPRECIATION.—The case for the cost-of-reproduction-less-depreciation theory is stated clearly by Mr. Whitten. He says that this early depreciation of possibly 15 per cent, which we have called "composite depreciation," is properly charged to earnings as it accrues. However, instead of being placed in reserve when it can never be used for the object for which it was intended, it should be used to reduce the capital to the permanent requirements of the business. While this is not done in practice, what amounts to very much the same thing is done; i.e., the funds are used in making additions and betterments. Again, Mr. Whitten suggests, that since the service of a public utility is a continuous one, and can be rendered only by a plant the parts of which inevitably depreciate, the investment cost must be assumed to be continuous; and while at first thought it may seem that a uniform investment cost can be secured only by assuming a uniform capital value, this would be true only so far as interest and profits are concerned, but would not give a uniform total investment cost. Investment cost consists not only of simple interest and profits on the investment, but also includes cost of necessary repairs, renewals, and replacements. Since this latter cost is greater in an old than in a new system, the investment cost must be equalized by making the charge for the interest and profits correspondingly less, which can be done only by decreasing the investment, using for that purpose the savings made during the early years when renewals are few.

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[4] *Knoxville v. Water Co.*, 212 U. S. 1; 53 L. ed. 371 (Jan. 4, 1909).

[5] See *Engineering News*, Jan. 29, 1914, p. 226, and Feb. 12, 1914, p. 350; also *Report of the Special Committee to Formulate Principles and Methods for the Valuation of Railroad Property and Other Public Utilities*, Dec. 1, 1913, p. 49.

Rates will not be reduced because of the depreciated value of the old plant, for with the increased expenditures for repairs, renewals, and replacements, rates would otherwise have to be increased. This can be avoided only by reducing the capital, and consequently the charge for interest and profits. In this way investment cost and charge are made uniform.

Causes of Disagreement.—The division of opinion as to the proper basis for rate-making is partly due to the apparent conflict of interest between the public service corporations and the people. That there is an equitable ground upon which to base rates could hardly be questioned. Integrity of investment must be observed, and any system of valuation that leads to confiscation is unjust. Investors and the people are both subject to imposition. The investor should afford suitable service and the people should pay therefor a price sufficient not only to return to the investor his capital, or prevent it from wasting, but also to afford him ample reward for his work in addition to the normal rate of interest on his money. No investor could ask for more; certainly the people should not be compelled to pay more. If a portion of the capital is returned to the stockholders in the form of dividends or by returning a portion of the company's securities, it would not be just to include the amount of such amortization for valuation purposes. The suggestion of Humphreys—that so long as service is efficient it is not the concern of the public what the amount of depreciation may amount to, since the proprietors are under obligations to make all necessary renewals and replacements—is not logical. Who can compel the stockholders of a utilities company to make further payments into the treasury after their stock is full paid? How else have replacements, too long deferred and unprovided for, been made than by the issue of bonds to secure the funds that should have been provided out of revenue, thus placing corporations under the permanent disability of large fixed interest charges?

Those who uphold the cost-new theory do so from the belief that if the cost-new-less-depreciation plan is adopted, the rates will be made lower. But such would be the case only for the corporation as a whole, not for the security holders, since a portion of capital has been amortized and therefore permanently withdrawn from the business. If, on the other hand, the amount representing this unavoidable depreciation is retained by being reinvested in the form of additions and betterments, the capital would remain the same. It would not represent an additional investment but merely a transfer of a portion of the capital from one form to another. Additional investments should come from the investors, not from the revenues of the company, and should be made out of net profits rather than from gross income before net profits are determined.

Decisions Noted.—The general theory of reproduction cost has been outlined above. It is impossible in the space allowable more than to notice the trend of decisions of courts and commissions. Reproduction cost considered in connection with depreciation has been probably the greatest single influence in the work of ascertaining value for rate-making. The earlier tendency to make reproduction cost outweigh all other influences has, however, been checked, and in some recent cases it has been entirely rejected, while in others it has been greatly modified and toned down. The California Commission has rejected the plan except in so far as it is helpful in throwing light on the investment in the property. As shown above, it was rejected by the United States Supreme Court in the *Minnesota Rate Cases,* and along with it the use of multiples in determining land values. Ordinarily pavement over mains is not allowed as a cost of reproduction,[6] nor in figuring the depreciation reserves, because any future additional cost due to laying mains under pavement will be a capital charge. In *Kings County Lighting Co. v. Willcox,* the Appellate Division of the New York Supreme Court said that the New York Commission erred in not allowing for pavement over mains. "While as to other items of physical property the Commission professed to appraise at its full value, and to apply the rule of cost-of-reproduction-new-less-accrued-depreciation, it refused to include in the value of mains under paved streets more than the original cost of repaving when the mains were relaid," etc. The Court of Appeals reversed this decision and sustained the Commission.[7]

In cost of reproduction valuations overhead may or may not be depreciated. In *Des Moines Water Co. v. City of Des Moines*[8] estimates for total cost of reproduction new are not given by the master, but his figures show that the allowances for overhead charges were depreciated from 6 to 13 per cent on the same allowances under the cost of reproduction new. In *Lincoln Gas & Electric Co. v. City of Lincoln* value was based on cost of reproduction less depreciation, but overhead was not depreciated.[9] In the New York, New Haven and Hartford appraisal, made to ascertain the relation of property values to securities, overhead was not depreciated and G. F. Swain, who was in charge of the appraisal, said:[10]

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[6] *Cedar Rapids Gas Light Co. v. Cedar Rapids,* 144 Iowa 426; 120 N. W. 966 (May 4, 1909). Affirmed by U. S. Supreme Court, Mar. 11, 1912, 223 U. S. 655.

[7] Whitten, R. H., II, 980-83.

> . . . If, therefore, the valuation is for the purpose of justifying rates or capital, 100 per cent. valuation should be taken. . . . It would appear that the physical valuation either for purposes of justifying rates or capitalization, should fairly allow the appreciated value of real estate and any other elements which have appreciated, without a corresponding allowance for depreciation of elements which have depreciated, provided the property is maintained in good condition.

In the *Chicago Gas Case* (1911) cost of reproduction new. was approved in a valuation made for a committee of the Chicago City Council on the ground that the "company in this case has charged operating expenses annually with an amount which is deemed sufficient to offset the depreciation."[11] This basis was also approved by the Wisconsin Commission in *City of Whitewater v. Whitewater Electric Light Co.*, "since although the investment may apparently be diminished by failure to provide for depreciation and by the payment of this money to owners or stockholders, in reality the investment is not diminished, because of the necessity of replacing the plant, in the absence of a depreciation fund, from the property of owners or stockholders." [12] The same basis was used by the Wisconsin Commission in *City of Racine v. Racine Gas Light Co.,*[13] as well as in a number of earlier cases. But in *Hill v. Antigo Water Co.,*[14] the Commission stated that it might under certain conditions deduct depreciation from cost of reproduction, and explained that this might be done where a company has had rates ample to cover all operating expenses, including depreciation, and to afford also a fair amount for interest and profits, but where the amount collected for depreciation has been distributed to stockholders. Reproduction cost new was approved in the *Columbus, Ohio, Electricity Rate Case,*[15] in 1906, but was regarded as simply one factor in arriving at a fair valuation.

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[8] No. 2468, in equity, U. S. Circuit Court, Southern Dist. of Iowa, Central Division.

[9] 182 Fed. 926, 928 (Apr. 6, 1909).

[10] Whitten, R. H., II, 223, 364.

[11] *Ibid.*, I, p. 365.

In his *Report of the Investigation of the Chicago Telephone Company,* 1912, Professor E. W. Bemis rejects the cost-of-reproduction-new-less-depreciation theory for certain purposes. This was the basis upon which appraisal of the physical property was made.[16] The Interstate Commerce Commission in carrying out the Valuation Act of 1913 found cost of reproduction new by assuming the non-existence of the railroad with all the other conditions in the same territory taken as existent at the date of valuation,[17] but it rejected present value of land. President Taft's Railroad Securities Commission [18] declared cost of reproduction of physical property to be but one element to be considered in determining present value.

In general, perhaps, it may be said that the rule employed in the majority of rate cases has been reproduction cost less depreciation. But it has been little more than a plan of procedure subject to constant modification and, in many instances, to rejection. In many cases it has been the controlling factor.[19]

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[12] 6 W. R. C. R. 132, 138 (Dec. 16, 1910).

[13] 6 W. R. C. R. 228, 284 (Jan. 27, 1911).

[14] 3 W. R. C. R. 623 (Aug. 3, 1919).

[15] Whitten, R. H., I, pp. 368-69.

[16] *American Economic Review,* III, p. 186.

[17] *Valuation Docket No. 2,* p. 11.

[18] *Report of the Railroad Securities Commission,* 1911, pp. 38-39.

Since a deduction from cost of reproduction to cover depreciation is an important consideration, it is necessary to determine what such a deduction shall cover. In the tentative valuation of the Texas Midland Railroad made by the Interstate Commerce Commission, cost of reproduction was found to be $3,627,313 and the depreciation deduction, $854,584, or about 23.5 per cent of reproduction cost. In the tentative valuation of the Atlanta, Birmingham and Atlantic Railroad the cost of reproduction was found to be $26,446,411 and the depreciation deduction $13,746,188, or nearly 52 per cent of reproduction cost. In the tentative valuation of the Kansas City Southern system the figures were: reproduction cost, $47,015,814; depreciation deducted, $7,148,722, or slightly over 15 per cent of reproduction cost.[20] These show wide ranges in the relative size of the depreciation deduction. The New Jersey Commission in one case [21] deducted 6.6 per cent for physical depreciation only. In the Texas Midland valuation the Interstate Commerce Commission allowed 50 per cent of replacement cost for ties. No reduction was made for depreciation of engineering and grading. For most items a normal service life was assumed and they were then depreciated on the basis of expired life.[22]

Conclusion as to Service Charges.—From the foregoing data and considerations we are able to see that cost of reproduction new and cost of reproduction less depreciation have played a very important part in the work of valuations undertaken to determine just service charges. It has been pretty generally rejected as the sole standard of fair value, but, on the other hand, it has been very widely adopted as one of the important standards of fair value—frequently the most important one. Its use is accompanied with difficulties of definition, and there is still a wide range of opinion as to its theoretical correctness. For certain purposes, such, for example, as land valuations, it has been definitely rejected. Its serviceability appears to be somewhat affected by rapid and great changes in price levels which often have little or no relation to invested capital. Engineers and economists have expressed approval and disapproval of it, absolutely, or have qualified their statements to meet varying situations. L. R. Nash[23] explains why depreciation should be deducted only when earned, probably the correct view. J. E. Allison explains why depreciation should never be deducted.[24] J. H. Gray explains why the method is wholly wrong.[25] It has been extensively criticized by John Bauer,[26] A. M. Sakolski,[27] and E. W. Bemis.[28]

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[19] Notably in the following cases: *Knoxville v. Water Co.*, 212 U. S. 1 (Jan. 4, 1909); *Pioneer Telephone & Telegraph Co. v. Westenhaver*, 118 Pac. 354 (Jan. 10, 1911); in many New York Public Service Commission, 1st Dist., cases (see Whitten, R. H., I, p. 376 *et seq.*) and in the *Minnesota Rate Cases*. For later cases see Whitten, R. H., II, pp. 1143, 1146, 1147, 1148.

[20] The latest valuation to be completed, that of the Chicago, Rock Island and Pacific Railroad, gives reproduction cost as $330,436,710, and depreciation deducted, $70,181,036, or slightly more than 21 per cent of reproduction cost. (*New York Times*, Sept. 11, 1921.)

[21] *Re Rates of Public Service Gas Co.*, 1 N. J. B. P. W. G. 433 (Dec. 26, 1912).

[22] See Appendix B.

Reproduction Cost—Capitalization

Capitalization value is usually synonymous with cost, consequently cost of reproduction is not ordinarily regarded as a proper base for the purpose of determining value for capitalization. Capitalization is an accounting problem and we ordinarily understand it to refer to an actual investment. Were it to include the unearned increment or to change with the continually changing costs of replacement, there would be no investment standard left. Capitalization is not a question of value but a measure of proprietorship. It does not give rise to the question of the confiscation of property under the fourteenth amendment, as do rate-making and public purchase. Depreciation is a factor only to the extent that it occurs during the construction period and to the extent that obsolescence and inadequacy of abandoned property may be capitalized as a replacement cost.[29]

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[23] *Valuation of Public Service Properties,* pp. 3-4.

[24] *Re Theoretical Depreciation.*

[25] *American Economic Review Supp.,* Mar., 1913, p. 27 *et seq.*

[26] *American Economic Review,* VI, p. 579 *et seq.*

[27] *Ibid.,* V, p. 14.

[28] P. 384.

In appraisals made to determine the relation of value to capitalization, reproduction cost and reproduction cost less depreciation may be proper bases of valuation. They were employed in the appraisal of the New York, New Haven and Hartford Railroad made in 1911. Overhead charges were not depreciated in determining cost of reproduction less depreciation.

Reproduction Cost—Taxation

Professor M. E. Cooley made an appraisal of the Michigan railroads to determine value for tax purposes, in the years 1900-1901. Reproduction cost less depreciation was the basis of this valuation but overhead was not depreciated,[30] except that the allowance for contingencies was reduced about 18 per cent. Ohio, Wisconsin, South Dakota, and New Jersey have also made physical valuations of railroad property, present value being determined by deducting depreciation from cost of duplication.[31] Whether this method shall be employed depends on the method of taxation in vogue. E. M. Bassett, Ex-Commissioner of the Public Service Commission of New York, First District, says:

> If it is decided that a public utility should be taxed on its total value as a going concern—that is, its commercial,

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[29] See pp. 22-34.

[30] *Report of Michigan Board of State Tax Commissioners*, 1902, p. 52.

[31] Ripley, W. J., *Railroads*, II, pp. 340-42.

> market or sale value—then franchise and going value will be included. If, on the other hand, the public-utility plant is to be taxed precisely as other real estate, the cost of reproduction less depreciation will be the basis.[32]

A study of assessed valuation, cost of reproduction new, and par values of stocks and bonds made of the Wisconsin railroads, showed that in some cases the cost of reproduction new was two or more times as great as assessed valuation, as determined by an estimate made by the State Tax Commission, while in other instances the Commission's estimate of value fell below cost of reproduction new.[33] The situation is thus summarized by Mr. Smith: [34]

> Physical valuation is not satisfactory as a sole method for the valuation of railroad property. It represents the cost of reproduction new, and a purchaser of one of the lumber railroads of the state would not give anything like the cost of reproduction for a road the value of which had largely departed with the cutting of the timber. Physical valuation is, then, only an aid in determining the market value of the property, possessing great significance in the case of the larger and more prosperous roads, but little significance in the case of some of the smaller roads. The per cent of physical valuation to assessed valuation is greater for the small roads, indicating that they are not earning a fair return on the capital invested. The Wisconsin tax commission fixes a low valuation and the per cent of net earnings to assessed valuation is fair; the per cent of net earnings to capital invested would be a very much smaller sum.

In a New York case [35] which involved the value of railroad right of way for tax purposes, reproduction cost was accepted as the basis of value, but this method was rejected in New Jersey in 1911.[36] The New York Appellate Court, reviewing the action of the State Board of Tax Commissioners, ordered that cost of pavement be included in reproduction cost in determining the value of a special franchise under the net earnings rule.[37] In the Wisconsin railroad appraisal made in 1903 for tax purposes cost of reproduction new and cost of reproduction less depreciation were determined, but overhead was not depreciated.[38]

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[32] *Proceedings, National Association of Railway Commissioners*, Washington, D. C., Oct. 10-13, 1911.

[33] Smith, Mark A., "A Rule for Testing Tax Valuations of Railroads," *American Economic Review*, VII, pp. 31-45.

[34] *Ibid.*, pp. 40-41.

[35] *People ex rel New York, Ontario & Western Railway Co. v. Shaw*, 143 App. Div. (N. Y.) 811; 128 N. Y. Supp. 177 (Mar. 8, 1911).

From the foregoing it appears that reproduction cost and reproduction cost less depreciation have been important factors in some valuations made for tax purposes. Ordinarily, however, such valuations are regarded as little more than aids in arriving at equitable tax values.

Reproduction Cost—Purchase

In modified forms the basis of reproduction cost has been extensively employed in making valuations for public purchase. Valuation for public purchase is in many respects analogous to valuation for rates. It is based ultimately on the same constitutional principle, namely, that private property must not be confiscated; but whereas in valuations for rates there are two primary factors, the value and the rate, in valuation for purchase there is but one, the value, and the justice of the procedure is wholly involved in fixing this value, because it is final. Nevertheless there may be items which may be included in a purchase valuation which should be excluded in a rate valuation. The Wisconsin Commission usually includes value of pavement over mains in purchase valuations but excludes it in rate valuations. In *Appleton Water Works Co. v. Railroad Commission* the Wisconsin Supreme Court said that in arriving at cost of reproduction for purposes of public purchase such cost shall be considered as "would be necessarily incurred by a reasonably prudent and careful man, using ordinary careful business methods, in reproducing a plant of equal efficiency." In one purchase case, however, the Wisconsin Commission did not allow for paving which the company was not required to remove when laying mains and services.

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[36] Whitten, R. H., II, pp. 966-68.

[37] *Ibid.*, p. 983.

[38] *Report of Wisconsin Tax Commission*, 1907, pp. 269, 285.

Interest during construction is usually included in both rate and purchase valuations. In laying down rules for an appraisal for municipal purchase the Supreme Judicial Court of Maine included "a fair rate—usually the prevailing rate—of interest upon the money invested in the plant during construction, and before completion" as a part of cost.[39] In Wisconsin, where the necessary cost of reproduction is included in valuations for purchase, donated property is not regarded as a reproduction cost if in case of reproduction it would be donated again. In the Memphis, Tennessee, water plant appraisal, 1902, 10 per cent on cost of reproduction, land excepted, was allowed for engineering, expenses, and contingencies, but in estimating depreciation these items were not depreciated.

H. V. Hayes maintains[40] that cost of reproduction new must govern in case of a private vendee because the reserves must be kept intact. But if the reserves are intact and if depreciation has been earned, cost of reproduction new would include both cost of original plant and of extensions financed from reserves, and to allow cost new on both would be to pay the vendee more than his original investment. Total cost of original plant plus cost of extensions financed from depreciation reserves less depreciation reserves would be the amount necessary to compensate the owner for his original investment. In general the same principles should govern the deduction for depreciation when cost of reproduction is the base as when original cost is the base. It also appears that the same principles should govern in purchase cases as in rate cases.[41]

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[39] *Brunswick & T. Water Dist. v. Maine Water Co.,* 99 Me. 371; 50 Atl. 537, 542 (Dec. 14, 1904).

[40] *Public Utilities,* II, pp. 239-41.

In *National Telephone Co., Ltd. v. His Majesty's Postmaster-General,*[42] 1913, the basis was nearly equivalent to production cost of physical property less depreciation. A "fundamental cost" was agreed upon which corresponds to cost of reproduction less depreciation, except that it included casualty insurance, an item of not much importance in the aggregate.

Under the terms of a Massachusetts law governing the establishment of municipal purchase of plants an appraisal was made of the gas and electric plant owned by the Holyoke Water Power Company. The special commissioners appointed by the Supreme Judicial Court to make the appraisal made the following statement regarding depreciation:

> The reproductive cost of all parts of the buildings and machinery that could be duplicated in January, 1898, and the market value of parts that could not be reproduced in the market.
>
> Less depreciation of all kinds whatever in the existing plants upon that date, arising from age, service, wear and tear, together with all defects therein, and all other causes and factors that lessen the value of the plants as they existed upon that date, and which would not pertain in any way to the reproduced plants.
>
> In this connection, as bearing upon the market value of the property, we have also taken into account, among other things introduced in evidence, the fitness, suitability and adaptability of the plants for the service required; their ability to supply present needs, and to what extent they can be depended upon to produce gas or electricity for the future; how efficiently and economically they can be carried on; their location with reference to facility for procuring supplies and to dispose of their product; and whether or not there are any faults or defects inherent in the plants, inde-

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[41] See p. 377.

[42] Whitten, R. H., II, pp. 1039-42; also Leake, P. D., *Depreciation and Wasting Assets* (rev. ed.), pp. 173-77.

> pendent of the diminution factors contained in clause third, such as any faulty arrangement of the works or any part thereof, inadequate facilities for their extension or for any necessary changes, any lack of capacity to supply the output for present or for future requirements, any undue expense necessary for repairs and replacements or other excessive cost of operation, or any other fault inherent in the systems, not included in clause third, which increases the trouble and expense of making and distributing gas and electricity, and thereby affects the market value of the plants. . . .
>
> We further considered upon this question all evidence tending to show that upon this date there could be obtained in the market buildings, mechanisms and materials, proper to be used in the making and distribution of gas and electricity, that were cheaper and more efficient, and which would produce more economical results in the plants in existence or as they could be duplicated. In so far as these facts affect and depreciate the value of any part of the existing plants in the market, we reduce by so much our valuation of the same.[43]

This allows for functional depreciation as well as physical. This report was confirmed by the court with the consent of both parties.

In the appraisal of the Gloucester Water Supply Company in 1899-1901 cost of duplication less depreciation was the basis of valuation but an allowance was made for going concern or established business equal to 13 per cent of the total. In approving this appraisal the Supreme Judicial Court of Massachusetts said:[44]

> It is plain that the real commercial market value of the property of the water company is, or may be, in fact, greater than "the cost of reproduction, less depreciation, of the different features of the physical plant." Take, for example, a manufacturing plant. Suppose one manufacturing plant

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[43] Whitten, R. H., I, pp. 449-50.

[44] *Gloucester Water Supply Co. v. Gloucester*, 179 Mass. 365; 60 N. E. 977 (June 19, 1901).

> has been established for some ten years and is doing a good business and is sold as a going concern. It will sell for more on the market than a similar plant reproduced physically would sell for immediately on its completion, before it had acquired any business. National Waterworks of New York *v.* Kansas City, 10 C. C. A. 653, 62 Fed. 853, 27 U. S. App. 165. We think it is plain that there is nothing in the provisions of section 16 of the act in question (st. 1895, c. 451) forbidding the commissioners considering this element of value, which, as we have seen, in fact exists. . . . It is plain that the element of value which comes from the fact that the property is sold as a going concern, in which case it has, or may have, in fact, a greater market value than the same property reproduced in its physical features, is not excluded from consideration by that provision of the statute. It is also plain that the commissioners, in allowing the $75,000 allowed by them in addition to the cost of reproduction, less depreciation, of the plant in its physical features, did not go beyond this.

The reader should note, in these two Massachusetts cases, that although cost of reproduction less depreciation is ascertained, the ultimate valuation is the "real commercial market value," such as is required to be found by the statute in case of the municipal purchases of utility plants. Cost of reproduction less depreciation was followed in *Town of Bristol v. Bristol & Warren Waterworks,*[45] and in the appraisal of property of the Bienville Water Supply Company in 1903.[46] Under the English Tramways Act municipalities pay the reproduction cost of the physical structure less depreciation, but going concern is allowed for.[47]

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[45] 23 R. I. 274; 49 Atl. 974 (July 27, 1901).

[46] Whitten, R. H., I, pp. 453-54.

[47] For additional cases see Whitten, R. H., II, Chap. 13. See also Hayes, H. V., I, pp. 239-41.

CHAPTER XX

THE BASES OF VALUATION—MARKET VALUE

General Remarks

Market value plays an important part in valuations for taxation and is frequently employed, in case of land, in arriving at fair value. It is frequently rejected in rate valuations for the obvious reason that market value is itself dependent on rates. Yet market value approaches most nearly to what is regarded as value in a popular sense. Market value disregards absolutely the amount of money actually invested in a plant, whereas fair value is usually determined with at least some consideration of the investment, while actual cost *may* coincide with the amount invested. Market value, like fair value, is a generalized expression used to indicate an amount which may be determined by a consideration of several, perhaps many factors. It is the business man's standard of value, and in a world of free competition where no favors are asked and no quarter granted, it is the standard. But where competition is absent or only partially effective this is not the case. Where the state determines to a large extent the conditions under which money shall be invested in properties which it regards as its wards and also the manner in which those properties must be operated, it cannot ignore the *cost* of the properties and attempt to base their *value* upon earning capacity which it through its power of control has more or less arbitrarily determined.

Nevertheless market value has played no insignificant part in valuations. It has been recognized as a factor by the Supreme Court of the United States.[1] It has been made the basis of valuation of railroads for rate purposes by the Washington

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[1] See p. 48.

Railroad Commission.[2] Ordinarily, however, a valuation based on so-called market value does in reality take into consideration various factors, such as cost of reproduction, the depreciated condition of the plant, and so on.

Market Value—Rate-Making

As mentioned above, the Washington Commission has employed market value as a basis of valuation, basing this in turn on a variety of factors. In *Paulhamus v. Puget Sound Electric Railway,*[3] the Commission allowed for favorable location and prospective growth in determining market value and also considered other factors as shown in the following quotation:

> The value of defendant's property used in this service has been found by the Commission, including working capital and supplies on hand, to be the sum of $4,070,237. This valuation was arrived at by ascertaining, after a most thorough examination by expert accountants, the amount expended by the company in constructing its lines, which was found, exclusive of working capital and supplies, to be $2,933,863.69; that it would cost to reproduce the property now at the present time $4,157,558 (this included an increase in the value of the right-of-way and terminals over what it cost of approximately $770,000); ascertaining the depreciated condition of the property; ascertaining the reflected value of the property as shown by the amount and value of its stock and bonds (the method followed is set out in the findings), found to be $3,987,376.23; ascertaining the density of the population and traffic and all other conditions which in the judgment of the Commission would affect the market value of the property.

MARKET VALUE AND COST OF REPRODUCTION—MULTIPLES.—Market value is sometimes an important factor in the determination of cost of reproduction, because reproduction costs are usually assumed to be what the market values of land and materials are at the time cost of reproduction is determined or what they average over a preceding period of, say, five years. Sometimes the market value of land is assumed to be increased by a "multiple" because of the additional value given to it by its newly assumed use. This matter was considered at length by the United States Supreme Court in the *Minnesota Rate Cases.*[4] Justice Hughes said, in part: [5]

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[2] Changed to the Public Service Commission of Washington in 1911. The statute of 1911 regulates the procedure in making valuation in detail. It makes the valuation base a composite one, but requires the Commission to "ascertain the total market value of each public company operating in the state." (Whitten, R. H., I, p. 48.)

[3] *Fifth Annual Report,* Washington Railroad Commission, Feb. 26, 1910, p. 28.

> These are the results of the endeavor to apply the cost-of-reproduction method in determining the value of the right of way. It is at once apparent that, so far as the estimate rests upon a supposed compulsory feature of the acquisition, it can not be sustained. It is said that the company would be compelled to pay more than what is the normal market value of property in transactions between private parties; that it would lack the freedom they enjoy, and, in view of its needs, it would have to give a higher price. It is also said that this price would be in excess of the present market value of contiguous or similarly situated property. It might well be asked, who shall describe the conditions that would exist, or the exigencies of the hypothetical owners of the property, on the assumption that the railroad were removed? But, aside from this, it is impossible to assume, in making a judicial finding of what it would cost to acquire the property, that the company would be compelled to pay more than its fair market value. It is equipped with the governmental power of eminent domain. In view of its public purpose, it has been granted this privilege in order to prevent advantage being taken of its necessities. It would be free to stand upon its legal rights and it can not be supposed that they would be disregarded.
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> It is urged that, in this view, the company would be bound to pay the "railway value" of the property. But, supposing the railroad to be obliterated and the lands to be

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[4] 250 U. S. 352; 33 Sup. Ct. 729 (June 9, 1913).

[5] For other excerpts from this decision see p. 345.

held by others, the owner of each parcel would be entitled to receive on its condemnation its fair market value for all its available uses and purposes. *United States v. Chandler-Dunbar Water Power Co.,* decided May 26, 1913. If, in the case of any such owner, his property had a peculiar value or special adaptation for railroad purposes, that would be an element to be considered. *Boom Company v. Patterson,* 98 U. S. 403; *Shoemaker v. United States,* 147 U. S. 282; *United States v. Chandler-Dunbar Co.,* supra. But still the inquiry would be as to the fair market value of the property; as to what the owner had lost, and not what the taker had gained. *Boston Chamber of Commerce v. Boston,* 217 U. S. 189, 195. The owner would not be entitled to demand payment of the amount which the property might be deemed worth to the company; or of an increase over its fair market value by reason of any added value supposed to result from its combination with tracts acquired from others so as to make it a part of a continuous railroad right of way held in one ownership. United States *v.* Chandler-Dunbar Co., supra; evidence before us from which the amount which would properly be allowable in such condemnation proceedings can be ascertained.

Also:

That question is whether, in determining the fair present value of the property of the railroad company as a basis of its charges to the public, it is entitled to a valuation of its right of way not only in excess of the amount invested in it, but also in excess of the market value of contiguous and similarly situated property. For the purpose of making rates, is its land devoted to the public use to be treated (irrespective of improvements) not only as increasing in value by reason of the activities and general prosperity of the community, but as constantly outstripping in this increase all neighboring lands of like character devoted to other uses? If rates laid by competent authority, state or national, are otherwise just and reasonable, are they to be held to be unconstitutional and void because they do not permit a return upon an increment so calculated?

It is clear that in ascertaining the present value we are not limited to the consideration of the amount of the actual investment. If that has been reckless or improvident, losses may be sustained which the community does not underwrite. As the company may not be protected in its actual investment, if the value of its property be plainly less, so the making of a just return for the use of the property involves the recognition of its fair value if it be more than its cost. The property is held in private ownership and it is that property, and not the original cost of it, of which the owner may not be deprived without due process of law. But still it is property employed in a public calling, subject to governmental regulation, and while under the guise of such regulation it may not be confiscated, it is equally true that there is attached to its use the condition that charges to the public shall not be unreasonable. And where the inquiry is as to the fair value of the property, in order to determine the reasonableness of the return allowed by the rate-making power, it is not admissible to attribute to the property owned by the carriers a speculative increment of value, over the amount invested in it and beyond the value of similar property owned by others, solely by reason of the fact that it is used in the public service. That would be to disregard the essential conditions of the public use, and to make the public use destructive of the public right.

The increase sought for "railway value" in these cases is an increment over all outlays of the carrier and over the values of similar land in the vicinity. It is an increment which can not be referred to any known criterion, but must rest on a mere expression of judgment which finds no proper test or standard in the transactions of the business world. It is an increment which in the last analysis must rest on an estimate of the value of the railroad use as compared with other business uses; it involves an appreciation of the returns from rates (when rates themselves are in dispute) and a sweeping generalization embracing substantially all the activities of the community. For an allowance of this character there is no warrant.

This is a very definite rejection of the use of multiples in determining land values when land is used for railroad purposes and at least a partial rejection of market value of land as a basis in determining present fair value. But it also shows to what degree market value is a factor in determining fair value.

LAND.—The St. Louis Public Service Commission appraises land at its present market value but employs actual or original cost in valuing equipment.[6] According to the California Commission fair value of railway land may be less than the market value of similar land in the vicinity. This question has been considered at length by the Interstate Commerce Commission in connection with its valuation work.[7] The Director of Valuation has declared that to ascertain the present value of land the number of acres of land owned or used by the carrier for its purposes as a common carrier should be multiplied by the "present market value" per acre of "similar, adjacent and adjoining lands," due allowance being made for the "peculiar adaptability of the land to railroad use." It rejected the use of multiples to find the "railway value," following the lead of the Supreme Court in the *Minnesota Rate Cases* and in *Denver v. Denver Union Water Co.*[8] The Washington and California commissions, reversing their earlier practice, have also rejected the use of multiples.[9]

NEW HAMPSHIRE COMMISSION CITED.—The New Hampshire Public Service Commission has held that in determining fair value it is desirable to know what a property would sell for in a "perfectly free and fair trade between two parties willing to buy and sell" and "acting under no compulsion or extraordinary incentive"; but this would be but one of several factors to be considered as shown by the following:[10]

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[6] Whitten, R. H., II, p. 947.

[7] *Valuation Docket No. 2*, pp. 52-62.

[8] 246 U. S. 178.

[9] *Public Service Commission v. Seattle, Renton & S. R. Co.*, 4 Wash. Pub. Serv. Com. Rep. (1914), 132, 134. *In re Value of Quincy Western Ry. Co.*, 8 Cal. R. R. Com. 340. The precedent established by the United States Supreme Court has also been followed in telephone cases by the Colorado and Washington commissions. Some commissions have never used multiples.

> In this case we have evidence of the most significant character tending to show what the properties proposed to be transferred would actually bring if sold under the circumstances above suggested. For in 1912 Mr. Streeter purchased the stock and bonds representing the entire ownership of these properties for a net price of $152,015.54. . . .
>
> The price finally agreed upon represents a composite judgment of the highest evidentiary importance as to the fair present value of these properties. In this price are summed up and given their due weight all the facts and circumstances entitled to consideration in determining that value—original investment, cost of reproduction, new and less depreciation, earning power (whether legally entitled to consideration, or not), capitalization, and all the advantages and disadvantages involved in being a public utility under the laws of New Hampshire.
>
> If the question is, what is the exchange value of a piece of property, the best possible evidence is a recent sale under such conditions as will give assurance that a fair price was obtained. If we wish to know how far a man can jump, we can have him examined by physical experts, and make various tests of the power of the muscles involved in the feat of jumping, and from all the evidence so obtained make an estimate as to his probable jumping ability. But the best way would be to take him out and let him jump—and measure the jump. In this case, the man has jumped. And estimates as to the probabilities become comparatively inconsequential in the face of the accomplished feat.

The Commission makes it clear that while the jump is the correct measure of market or exchange value it is not the only measure of fair value.

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[10] *Petitions of Grafton Electric Light & Power Co.*, 28 A. T. & T. Co. Com. L. 553 (Feb. 3, 1914). This was a capitalization case but the Commission held that the principles involved applied also to rate cases.

As thus limited and conditioned, how is the problem of market value for purposes of rate-making affected by depreciation? It seems clear that in so far as we limit ourselves to a consideration of land values,[11] depreciation is not likely to be a matter for consideration. Here the reverse of depreciation, namely, appreciation, is a more important problem. This has been considered by the United States Supreme Court and the state commissions, which have tended to reject the use of multiples and, in some instances, cost of reproduction as determined by valuations of adjoining lands. In so far as market value of wasting assets is concerned, it does not appear that the depreciation problem is different than when cost of reproduction is the basis. It is a question to be determined by the facts concerning the establishment of the reserve. If depreciation has been earned and the reserve is intact, it ought to be deducted in arriving at fair value for rate purposes. If it has been earned and distributed to stockholders, it ought to be deducted; but if, under good management, the utility company has been unable to earn its depreciation, it ought not to be deducted in ascertaining fair value.

Market Value—Capitalization

We have noticed the tendency to base capitalization on cost and the efforts of commissions having power over security issues to make them represent full par value. Capitalization is strictly an accounting problem, and accounting proceeds from a cost basis, not one of market value, in so far as fixed assets are concerned. Nevertheless there are many necessary departures from these general rules. Sometimes cost cannot be determined; sometimes it is so far out of consonance with existing conditions that to adopt it works inevitable injustice.

In *Petitions of Grafton County Electric Light & Power*

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[11] See pp. 432-443.

Co.,[12] the New Hampshire Public Service Commission stated that the price obtained at a sale is of some aid in determining fair present value for capitalization purposes. The Michigan Commission has held that fair market value as represented by initial cost plus certain developmental expenses is the proper basis of capitalization. This was found to be, in one case:[13]

Original land cost	$ 500,000
Service in acquiring	500,000
Interest during purchase	150,000
Cost of promotion	300,000
Total	$1,450,000

The Texas railroad appraisal of 1894 was made to regulate security issues. In this sparsely settled state land values were not sufficiently great to be a factor of much importance. The basis of valuation of right of way and real estate was the current market value of immediately adjoining property.[14]

When market value is made the basis of capitalization the depreciation reserve, if earned, should be deducted from total market value. If, under good management, it has not been earned, it should not be deducted. If it has been earned but distributed, it should be deducted. Not to deduct an earned reserve would permit the company to capitalize extensions constructed from the reserve as well as the market value of the original plant. Where, however, market value is determined, not on the basis of earning power but on that of cost, and allowance is made for depreciation, the reserve should not be deducted. The above statement is a mere generalization which may not always apply because of the lack of correspondence between the figures representing cost and reserves on the one hand and market value on the other.

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[12] 28 A. T. & T. Co. Com. L. 553 (Feb. 3, 1914).

[13] 19 A. T. & T. Co. Com. L. 244 (June 11, 1913), Michigan Railroad Commission.

[14] *American Economic Review*, VI, p. 297.

It should be borne in mind, however, that actual cost is usually a better basis upon which to determine capitalization than is market value.

Market Value—Taxation

Market value has been an important factor in valuations for tax purposes. Michigan made an appraisal for tax purposes in 1900, reliance being placed chiefly upon the estimates of special appraisals and real estate experts.[15] Here for the first time "multiples" were employed, these being applied to the values ascertained by the experts. The percentage added varied from 100 to 300 per cent with an additional fixed charge of from $3 to $8 per acre to cover costs of acquisition and so on. The results were regarded as unsatisfactory and another valuation was made in 1902. To determine the actual costs of buying land the county records were studied and abstracts were made of all transfers over a preceding period of ten years, and the average price paid per acre for various classes of land was completed. This was compared with the transfers of improved and unimproved lands adjacent to railroads. The results showed that the earlier valuation had undervalued the real estate owned by the railroads.

In 1903 the Wisconsin Commission made an appraisal for tax purposes. As an additional protection in its attempt to arrive at correct market values, the Wisconsin Commission applied to the average transfer price per acre a percentage which represented the ratio of the average assumed value of the land in a given locality to the average price which had been paid for that land.

The railroads of Wisconsin are now required by law[16] to pay the true average rate of taxation on the market value of their property. This is interpreted as being the amount that could be realized from a sale of that property under normal conditions.[17]

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[15] Sakolski, A. M., *American Economic Review,* VI, pp. 297-98.

[16] *Wisconsin Statutes,* 1915, ch. 51, 14.

In 1911 New Jersey made an appraisal of railroads for tax purposes. Reliance was placed chiefly upon the market values of adjoining lands, and only 7 per cent was added to represent incidental costs. The law required the elimination from consideration of the purpose to which the land was applied. The following is quoted from the report of M. Hansel on this subject:[18]

> No per cent has been added to the value of lands in excess of the value in exchange for money, as near as such value can be determined by the exchange price of lands adjoining the lands of the railroad in each particular taxing district, and at each particular point where such lands adjoin railroad lands. The cost of acquiring the land has not been taken into consideration, as has been frequently done by other states which have attempted to determine the value of the physical property of railroads, excepting that administration and interest at 7 per cent has been added to land in main stem. It is generally conceded that a railroad seeking to acquire rights of way through a village, town or city, or through a well-improved and highly developed farming section, must pay, for the land necessary for the right of way, a sum considerably in excess of the rate of the going price of the property they desire to acquire; and, in many cases, where a community is in great need of railway facilities, the cost of acquiring the land is considerably below the value of the adjoining lands. . . .
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> The law tells us to eliminate from our consideration the purpose to which the land is applied. Therefore, we have valued the land stripped of all improvements as a piece of naked land, in the open market, for any reasonable purpose to which it may be applied. The presence of a railroad, with its embankments, permanent way and structures, and

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[17] A description of the various methods of commercial valuation may be found in Bulletin 21 of the Bureau of the Census, issued in 1905 and entitled, "Commercial Valuation of Railway Operating Property: 1904."

[18] *Report on Revaluation of Railroads and Canals,* 1911, pp. 69-70.

> the operation of traffic over same, may depreciate or appreciate the value of the adjoining lands; consequently, the "true value" is so closely interwoven with the value for a specific purpose that it is difficult to determine whether the value of the adjoining lands would be enhanced or depreciated by the absence of the railroad, with its embankments, and the operation of trains over same.

Sometimes market value is secured by capitalizing net earnings, but in case of valuations for tax purposes it is more customary to base valuation on comparisons of sales of property located similarly to that which is being valued. Where the net earnings method is followed, current depreciation becomes a factor of first-rate importance because its deduction from gross income is necessary to a correct statement of profits. This is using the term in a different sense from that signified when depreciation accrued is deducted from cost of reproduction in order to determine present value. Such a deduction is not ordinarily made in cases of valuations made for the purpose of finding market value for taxation, because when land is under consideration depreciation is not usually a factor and because in the comparison of one property with others of similar type or location, depreciation, if it exists at all, is automatically taken care of in the regularly established price of the property.

There is a certain sense in which depreciation is a very important factor in determining railroad right of way and one which tends to throw discredit on the assumption that value of the right of way for tax purposes as well as for other purposes is the same as that of similar areas of adjacent land, namely, this, that the cost of right of way is determined not only by what was the value of the land purchased for railroad purposes but by the amount that this severance for a special purpose causes adjoining land to depreciate in value. It is the "diminution in the value of the whole parcel from which the right of way strip is severed,"[19] and this is true in spite of the assertion of the United States Supreme Court to the effect that a "fair average of the normal market value" of adjoining land of similar characteristics is the true measure of the right of way of railroads.[20] It is possible that the effect on neighboring land may be neglig~~ent~~ible or even favorable, causing appreciation, but such is not usually the case.

Market Value—Purchase

As market value is not ordinarily a factor in valuations for rate-making except in so far as it may be of collateral assistance in the determination of fair value, so it is not usually the chief factor in appraisals for public purchase. No doubt the market value of outstanding securities should receive some consideration, but this is not the same thing as the market value of the plant itself. To accept market value as the proper basis for public purchase would be to capitalize present earning capacity, which in turn is based on present rates, which may represent either too great or too small a return on a fair valuation.

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[19] *Baumann v. Ross,* 167 U. S. 575 *et seq.*

[20] *Minnesota Rate Cases,* 230 U. S. 352.

CHAPTER XXI

DEPRECIATION RESERVES IN VALUATIONS

The Problem Stated

Any definition of "fair value," in the sense in which the term is employed by courts and commissions in connection with the valuation of public utility properties, is subject to various limitations and conditions. Moreover, other things being equal, fair value may be different for rate-making from what it is for taxation, and fair value for purchase may differ from fair value for rate-making or for taxation.[1] In reality, other things usually are not equal. Historical development, financial methods, accounting procedure, and peculiarities of circumstances surrounding individual cases make uniformity of procedure in determining fair value impossible. This accounts for discrepancies in the definitions of fair value which have been submitted to us. However that may be, since the Supreme Court of the United States handed down the decision in *Smyth v. Ames,* in 1898, fair value has been the accepted basis of procedure in the determination of the rights of capital invested in public utilities.[2]

COST BASIS REJECTED.—The adoption of a theory of valuation and the rejection of actual investment as a basis for rate-making, whether or not sound from an economic point of view, has greatly complicated the problem of regulation. It has, in part at least, divorced the question from a consideration of those records which are best adapted to supply information regarding the inception and growth of an enterprise, that is, the accounting records. Even though correct accounting methods have been pursued and capital expenditure and expense have been carefully distinguished, the results do not afford a sufficient basis for the solution of the problem of fair value. The science of accounts proceeds from an investment or cost basis where fixed and wasting assets are concerned. The Supreme Court has rejected cost as the exclusive basis for determining fair value in rate cases. It has said:

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[1] Henry Floy, in *Valuation of Public Utility Properties* (p. 10), says: "The determination of the fair value of a given property to be used as a basis for fixing proper returns or rates to be charged, depends upon the value of the property being used in the service from which the returns or rates are earned and is ofttimes quite different from the fair value of the total property of any utility, part of which may be held for future extensions or profit or use for extraneous purposes, but all of which have to be considered and allowed in case of capitalization or purchase or sale, as a whole."

[2] The correctness of this decision has been seriously questioned. Thus James E. Boyle says: "It was a judicial error—and one of the first magnitude—that gave us the doctrine of valuation instead of investment as the basis of rate making." (*American Economic Review, Supp.,* IV (Mar., 1914), p. 54. See the criticism by Professor H. C. Adams in his *Railway Accounting.*

> In determining fair value of a property original cost of construction, the amount expended in permanent improvements, the amount and market value of its bonds and stocks, the present as compared with the original cost of construction, the probable earning capacity under particular rates prescribed by statute, and the sum required to meet operating expenses, are all matters for consideration and are to be given such weight as is just and right in each case. We do not say that there may not be other matters to be regarded in estimating the value of the property.[3]

CONCEPTION OF FAIR VALUE.—An adequate conception of fair value, as thus defined, must take account of various and complicated conditions. Rules which establish a "fair value" which is fair to a new company may be unjust to an old one.[4] Questions sometimes arise as to the inclusion of certain items in fair value, such, for example, as surplus,[5] unearned increment,[6] going value,[7] unearned depreciation,[8] and depreciation reserves.

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[3] *Smyth v. Ames,* 160 U. S. 466 (1898).

[4] See Hayes, H. V., *Public Utilities,* II, p. 16.

[5] *American Economic Review, Supp.,* IV (Mar., 1914), p. 33.

[6] Hayes, *Public Utilities,* II, pp. 26-32, 41.

[7] Floy, H., *Valuation of Public Utilities,* p. 17.

[8] Nash, L. R., *Valuation of Public Service Properties,* p. 4.

STATUS OF RESERVES.—Most of our utility companies either have not established depreciation reserves, on the theory that repairs are equivalent to depreciation, or have set up reserves which are entirely inadequate. Failure to establish adequate reserves may be ascribed to various reasons. There is a belief on the part of some utility managers and utility accountants that depreciation reserves are prejudicial to the interests of their companies and that in a valuation these reserves will in some manner be manipulated to lessen fair value. Moreover, some writers have attempted to show that depreciation reserves are worse than useless because they tie up funds which are not needed in the business and which ought either to be returned to the investor as dividends or employed in making extensions and improvements.

There is much sophistry and some truth in these contentions. Repairs are not equivalent to depreciation, although in some plants possessing a great extent and variety of assets, "repairs" may be made to include extensive replacements without putting an undue burden upon the revenues of any year or period of years. Depreciation reserves are not prejudicial to the best interests of public utility companies but on the contrary are one of the best safeguards against insolvency. It is true that the improper treatment of depreciation in valuations has injured some utility interests. But depreciation reserves are not useless. Ordinarily they do not tie up money which ought to be usefully invested. Perhaps there may be found instances where excessive reserves have been established, others where the reserves have been misused, and others where improper regulations or a failure to understand their true character have prevented their most advantageous use.

The purpose in making reservations for depreciation is to bring into profit and loss a charge equivalent to the current fiscal period's "expired outlay on plant." This is such a part of the *cost* of wasting assets as a fair judgment informs us represents the expired outlay on plant for such fiscal period. The various methods employed for allocating depreciation expense over fiscal periods have been discussed in Chapter VII. Here it is only necessary to note that the sum to be allocated is cost less salvage and that the time during which such allocation is made is the useful life of the asset in question.

FAIR VALUE AND COST.—Certain fundamental considerations apropos of the question of fair value arise from the fact that accounting—and therefore depreciation reserves—always refers back to cost. Accounting, in so far as it deals with wasting assets productively employed, ignores fluctuations in market prices. Being based on cost, it also ignores fluctuations in the purchasing power of money. Thus, if a machine was installed in 1910 at a cost of $1,000 and possessed a useful life of ten years, it is correct accounting practice to charge off $1,000 less salvage and to establish a reserve for that amount, although it may cost, possibly, $1,500 to replace the machine in 1920. The additional $500 required to make the replacement must be provided as an additional investment. This means that during periods of rising prices depreciation reserves which amortize the cost of wasting assets are inadequate for making replacements. Additional capital must be invested to make up the difference between replacement cost and the cost of the parts replaced. Investment in plant, rolling stock, and machinery is crystallized and cannot be varied to reflect increasing or decreasing market prices by means of adjustments made from time to time in the accounts.

Over extended periods of time the swing of the price pendulum may serve to compensate such inequalities to a certain extent but it is not likely to bridge the distance between former costs and present values of land. At best, therefore, we cannot always hope to harmonize original investment with fair value, and accounts, even though properly kept, do not afford all the information needed in order to determine fair value.

A scheme of accounting which throws an enterprise out of adjustment with actual conditions may seem to be subject to severe criticism, but there are reasons why accounting must proceed from a cost basis. To adopt a different plan would be to reject one of its most fundamental tenets, namely, that profit and loss must be realized, not be merely the result of adjustments on paper. Not even stock in trade can be written up before it is sold, and for a manager to list his inventories above cost gives rise to the question of his good faith. The Bureau of Internal Revenue has pursued the settled policy of deducting as expense "that amount which should be set aside for the taxable year in accordance with a consistent plan by which the aggregate of such amounts for the useful life of the property in the business will suffice, with the salvage value, at the end of such useful life to provide in place of the property its cost." [9] Assets of the most permanent character are ordinarily the ones which necessitate the heaviest outlays of capital. These possess a useful life sufficiently long to render impossible an attempt to keep recorded value in agreement with market value.

Depreciation reserves have one chief purpose—the return, through revenues, of the cost of assets during their useful lives. If prices rise, the investor loses; if they fall, he gains, because in the former case the amount returned is not sufficient to replace in kind and in the latter case it is more than sufficient. As this is a risk which all capital takes, it appears that in determining fair value the investor who loses owing to rising prices should not be compensated for his loss nor should he who gains owing to falling prices be deprived of his gain.

Problem of Fair Value and Reserves

Omitting further consideration of discrepancies in depreciation reserves resulting from changing cost of replacement, we may ask: How is the depreciation reserve related to fair value? Does the depreciation reserve aid in determining fair value, when it exists? If so, is it part of fair value or ought it to be deducted in arriving at fair value? Do the same answers hold for fair value in any case, whether for rate-making, taxation, or purchase?

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[9] *Reg.* 45, Art. 161.

Previous considerations have shown that the depreciation reserve does not determine fair value, because it is based on cost. Were it accepted as the sole criterion it would be necessary to exclude consideration of fluctuating values, unearned increment, going concern, and the like. It would limit the use of the word "value" to cost less depreciation or to cost, according as the depreciation reserve is or is not a proper deduction. Broadly interpreted, fair value would be determined with reference to past, not present, conditions. We can hardly conceive a plan which determines all elements of value with reference to costs.

ATTITUDE OF COURTS AND COMMISSIONS.—*Smyth v. Ames* rests the matter on general conceptions and suggests the difficulty of any fixed standard of valuation. It shows, as do most broad decisions, that there may be no generally controlling factor. The problem cannot be solved by the use of *a priori* methods because each case presents individual peculiarities.

Depreciation reserves have figured extensively in valuations. The following instances may be noted. Commissioner Eshleman, of the California Railroad Commission, has rendered an opinion to the effect that earnings should not be permitted on the depreciation reserve, even when it is invested in extensions.[10] This is substantiated in *Louisiana R. R. Commission v. Cumberland Telephone & Telegraph Co.*;[11] also in *Louis-*

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[10] Whitten, R. H., *Valuation of Public Service Corporations*, II, p. 1186.

[11] 212 U. S. 414 (1909). See Hayes, H. V., *Public Utilities*, I, pp. 224-27.

ville & Nashville R. R. Co. v. R. R. Commission of Alabama,[12] in which the special master said:

> But however that may be, the management is entitled to the whole capital at 100 per cent of value and the (apparent) replacement balances at any moment stand precisely as a part of the capital—that is, as value expended by use and replaced by depreciation assessments in transit for renewal investment.

If the reserve is deducted from cost of assets to determine depreciated value, and earnings are permitted on the depreciated value only, then earnings should be allowed also on the reserve. On this point the court in the last case cited above said:

> But as pointed out in argument, the net results of operation, including operating expenses, are in this instance allowed credit for interest on depreciation, because the full amount of accrued depreciation is deducted from the value of property on which return is claimed.

This is equivalent to allowing a return on original cost, which, according to the investment theory, is correct if all capital invested is "used and useful" and if capital has not been reduced. Present cost new is larger than original cost new by the amount of the reserve invested in additions or betterments and upon this excess no return should be earned. To permit a return on the reserves in addition to a return on cost is equivalent to capitalization of the reserve.[13]

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[12] Whitten, R. H., II, p. 1188.

[13] There is an exception to this rule in case the sinking fund method is employed. Then the amounts set aside for depreciation are presumed to earn interest which is added to the fund. Whether or not a fund is actually set aside, the company must sacrifice the interest necessary to create a reserve which will ultimately be as large as the straight-line method would provide. Consequently the reserve ought not to be deducted in arriving at fair value. The company loses the interest on the amount of the reserve, hence it would be unjust to deduct it from original cost in ascertaining fair value. It would appear, however, that where the reserve actually earns more than the rate allowed for under the sinking fund method there should be deducted the capitalized value of such excess. In accordance with this principle E. W. Bemis recommended cost new in the *Chicago Telephone Case.* Commissioner Stevens of the New York Public Service Commission, Second District, makes a similar recommendation (Whitten, R. H., II, p. 1165).

THE PROBLEM ILLUSTRATED.—Assume the case of a utility having assets representing an investment of $5,000,000; capital stock outstanding, $3,000,000; first mortgage bonds, $1,500,000; and other liabilities, $500,000. The balance sheet at the close of the construction period stands thus:

Non-Depreciating Assets.	$2,000,000	Capital Stock	$3,000,000
Depreciating Assets	3,000,000	First Mortgage Bonds...	1,500,000
		Other Liabilities	500,000
	$5,000,000		$5,000,000

Assume, further, that the wasting or depreciating assets are divisible into four classes, as follows:

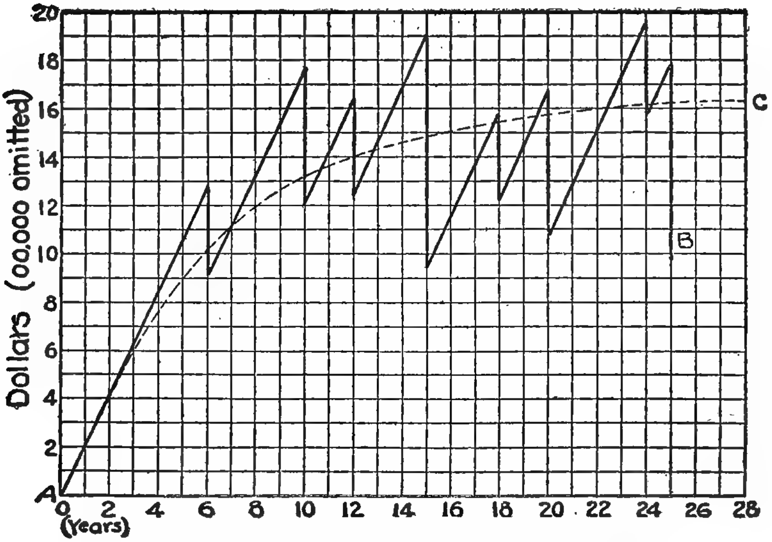
Cost	Life	Estimated Salvage	Yearly Depreciation
$ 400,000	6 years	$ 40,000	$ 60,000
600,000	10 "	30,000	57,000
1,000,000	15 "	40,000	64,000
1,000,000	25 "	200,000	32,000
$3,000,000		$310,000	$213,000

This means that, following the straight-line method of writing off depreciation, profit and loss will be charged, each year, $213,000, and a corresponding credit of $213,000 will be entered in the Depreciation Reserve account. It is, of course, impossible in practice to subdivide wasting assets into definite classes, each class having a fixed useful life. Some replacements will be made long before the expiration of six years and these will tend to increase gradually until the plant arrives at a condition of normal depreciation. To simplify calculations, assets are arbitrarily divided into the four classes shown above.

According to our assumptions, at the end of the sixth year the depreciation reserve will stand credited with 6 × $213,000, or $1,278,000. At this time class one of the wasting assets will be retired, being charged against the reserve at cost less salvage, or $360,000, leaving in the reserve a credit balance of $918,000. At the end of the tenth year the reserve will have a credit balance of $918,000 + (4 × $213,000), or $1,770,000. At this time class two of the wasting assets will be retired, being charged at cost less salvage ($570,000) against the reserve, leaving in it a credit balance of $1,200,000. The following table shows the status of the reserve at times when replacements are made, to the end of the twenty-fifth year, when every class of assets will have been replaced one or more times:

	Depreciation Reserve		Retirements Charged to Reserve		Balance in Reserve
End of 6th year	$1,278,000	less	$360,000	leaving	$ 918,000
End of 10th year	1,770,000	"	570,000	"	1,200,000
End of 12th year	1,626,000	"	360,000	"	1,266,000
End of 15th year	1,905,000	"	960,000	"	945,000
End of 18th year	1,584,000	"	360,000	"	1,224,000
End of 20th year	1,650,000	"	570,000	"	1,080,000
End of 24th year	1,932,000	"	360,000	"	1,572,000
End of 25th year	1,785,000	"	800,000	"	985,000

In this assumed illustration the reserve varies considerably from period to period. It tends, however, to approach a status of normal depreciation. In a large plant where the replacements are sufficiently numerous to spread the charges against the reserve evenly over successive periods the reserve undergoes a steady growth, but at a constantly diminishing rate, until the plant arrives at a condition of normal depreciation, after which the reserve remains stationary because abandonments offset reservations. This is only theoretically true, of course, because in practice, even in case of the largest plants, replacements vary somewhat from year to year. The accompanying chart (Form 11) shows graphically, *AB,* the growth of the reserve in our assumed illustration; also the growth of an ideal reserve, which is an evenly progressive curve, *AC*, because the replacements are spread evenly and in increasing amount until, at about the twenty-eighth or thirtieth year, they exactly offset the amount set aside for depreciation. At this point the plant is said to have arrived at a condition of normal depreciation. Normal depreciation amounts to about $1,630,000. The reserve remains at this figure, after the condition of normal depreciation has been reached at about the end of the thirtieth year.[14] Assuming that this amount represents the ultimate normal depreciation in case of the utility company and that it is reached at the end of the thirtieth year, the balance sheet might then appear as follows:



Form 11. Diagram Showing Growth of Depreciation Reserve

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[14] Since the illustration given is hypothetical, the time, amounts, and percentages do not in themselves have any special significance. These will naturally vary in any actual case with conditions peculiar to the plant. In the diagram, curve *AC* is assumed and is not directly related to the data from which *AB* is drawn.

Non-Depreciating Assets	$2,000,000	Capital Stock	$3,000,000
Depreciating Assets (original)	3,000,000	First Mortgage Bonds	1,500,000
		Other Liabilities	500,000
Depreciating Assets (reserve invested)	1,630,000	Reserve for Depreciation	1,630,000
	$6,630,000		$6,630,000

All items are purposely unaltered with the exception of the introduction of the depreciation reserve and the account representing the investment of the reserve in extensions to property.

Comparison of this balance sheet with the preceding one indicates that "cost" of property is increased from $5,000,000 to $6,630,000, 32.6 per cent of the original investment, or 24.6 per cent of total investment (original plus reserve). Of the total cost of property, nearly one-fourth has been paid out of the depreciation reserve. However, the relative size of the reserve is not pertinent to this discussion.

Nature of Depreciation Reserve

The depreciation reserve is a valuation account. Appearing frequently on the liability side of the balance sheet, it is apt to be confused with surplus. Such a conception of depreciation is as wrong as is the notion that depreciation ought to be or can be set aside from net profits. Unless gross revenue is charged with a reasonable amount to cover both realized and accrued depreciation, net profits cannot be ascertained. When such a charge is made a smaller amount is carried to the Surplus or Dividends Payable account than would be the case were no reservation made for depreciation. It prevents the distribution of capital as dividends. The increase in cost of assets, amounting to $1,630,000, does not represent an additional investment of the stockholders or bondholders. It simply offsets accrued depreciation of partially worn-out units of plant.

The fact that original plant is 32.6 per cent worn out does not mean that it is giving less efficient service than when new. Its efficiency ought to continue unimpaired and perhaps increase. It is for this reason that the company should receive a fair return, not on the depreciated value of the original plant, but on its cost, plus or minus any amount which considerations not related to this discussion may make equitable. A return ought not to be earned on the reserve, however, because it offsets the accrued depreciation which is not deducted in the balance sheet.

It has been stated that the reserve is the property of the public and therefore should not be permitted to earn a return. This is erroneous. The amount reserved is definitely the property of the company returned through the rates to offset accrued depreciation on plant but which has not been deducted from cost. If the accrued depreciation were deducted from cost of plant in determining fair value then, on the contrary, extensions financed out of depreciation reserves ought to be included in fair value.

COROLLARY CONSIDERATIONS.—Certain corollary considerations arise, as follows:

1. When revenues have not been sufficient to afford a fair return and also to establish depreciation reserves, so that no reserve has been set up.
2. When revenues have been sufficient to afford a fair return and also to establish depreciation reserves, but no reserve has been set up.
3. When the reserve is employed to amortize capital.

The situation suggested in (1) is analogous to that of many public utilities. If, in such cases, accrued but unearned depreciation is deducted in determining fair value the investment is depleted, because no offset to accrued depreciation exists in the form of extensions, betterments, or investments, paid out of the reserve. The company has consumed capital to pay running expenses and no allowance is made for this in fixing fair value. If the depletion in capital has been caused by mismanagement the loss should not be capitalized; otherwise it should be included in fair value.

When, as in (2), depreciation has been earned but distributed, it should be deducted from cost in determining fair value. Not to deduct it is to permit the company to capitalize that which it has returned to its stockholders. Carried to its logical conclusion this is equivalent to allowing rates sufficiently high to cover depreciation, permitting the company to distribute it, and then replacing the plant free of cost to the company when worn out.

When, according to (3), the reserve is employed to amortize capital, depreciation should be deducted in determining fair value. The legitimate use of the reserve is to serve as an offset to accrued depreciation. If it is used to amortize capital the equity of the owners is reduced to that extent. They cannot expect to secure a return on what they originally invested, for allowance must be made for what has been returned to them.

This chapter is written with special reference to fair value for rate-making. Fair value for purchase or taxation may not be the same as fair value for rates; indeed, it is not likely to be the same. The qualification of "used and useful" may not apply. In so far as fair value is determined by the depreciation reserve it does not ordinarily vary, however, whether for rate-making, purchase, or taxation. The reserve represents wealth only vicariously, because there is a corresponding decline in service value in original investment which is not reflected in the asset accounts.

CHAPTER XXII

VALUATIONS—CONCLUSION

Other Bases of Valuation

The preceding discussion has recognized three important formal bases of valuation. The general plan of procedure has been to simplify, in so far as possible, a complex subject without at the same time making the treatment appear artificial and impractical. In fact, the various bases are applied satisfactorily only when their use is accompanied by all necessary reservations and qualifications which good judgment and careful study determine to be necessary in any given instance. Moreover, other bases than those described above are frequently employed.

Sometimes the base or the bases to be used are prescribed by statute and frequently by courts, and these sometimes enumerate many factors to be taken into consideration by the appraisers. The Supreme Judicial Court of Maine, in laying down rules for the appraisal of the "plant, property and franchises, right and privileges" of the Maine Water Company at what they are "fairly and equitably worth," included among the factors to be considered in arriving at such worth the following:[1]

1. Cost of maintenance or depreciation.
2. Current operating expenses.
3. Right of the public to have no more exacted than the services themselves are worth.
4. Degree of hazard to which the original enterprise was naturally subjected.
5. An ample and fair public policy.

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[1] *Kennebec Water Dist. v. City of Waterville*, 97 Me. 185; 54 Atl. 6 (Dec. 27, 1902).

6. Income already received at rates in excess of what would otherwise be reasonable.
7. Revocability and possibility of legislative repeal of franchises.
8. Monopoly of business possessed by the company.
9. Actual cost of construction of the plant, with proper allowances for depreciation.
10. Going concern value.
11. Actual rates and earnings of past periods.
12. The quality of water furnished and service rendered.
13. The fitness of the plant and of the source of water supply to meet reasonable requirements in the present and future.
14. Cost of replacing of the existing system by one substantially like it.
15. Goodwill, in so far as the system is not exclusive.
16. The present efficiency of the system.
17. The length of time necessary to construct the system *de novo.*
18. The time and cost needed to develop such new system to the level of the present one in respect to business and income.
19. The added net income and profits, if any, which by its acquirement would accrue to a purchaser during the time required for such new construction, and for such development of business and income.
20. Franchises, rights, and privileges to be taken, the value of the franchise being dependent upon its net earning power, present and prospective, developed and capable of development, at reasonable rates; the value to be assessed being value to the seller, not to the buyer.
21. In considering such prospective development of the use of a franchise, the fact to be considered that further investment may be necessary to develop that use, also that at any stage of development the owner of the franchise will be entitled to charge only reasonable rates under the conditions then existing.
22. Appreciation due to natural causes.
23. Present and probable future earnings at reasonable rates.

The court adds:

> As to the property to be taken, both plant and franchises are to be appraised, having in view their value as property in itself, and their value as a source of income. There are these elements of value, but only one value of one entire property is to be appraised in the end. These elements necessarily shade into each other.

This was a valuation for purposes of municipal purchase and illustrates well the essential complexity of the work of making an adequate appraisal. We must not be led to the conclusion that all such factors are of equal importance, however, or that the same factors necessarily have equal importance in different valuations, or in valuations of the same property made for different purposes.

Depreciation under Different Bases of Valuation

This naturally gives rise to the question whether or not the factors of depreciation, obsolescence, inadequacy, and appreciation are to be governed by the same consideration in all kinds of appraisals. If the value of a given asset is included in value for taxation purposes but is excluded from fair value for rate purposes, in so far as it is affected by depreciation the extent of the depreciation should be a matter for consideration in the tax appraisal but may be neglected in the rate appraisal. Whether depreciation should be given precisely the same weight in case of plant which is included in appraisals made for two or more distinct purposes is a more difficult matter to determine. It should if different bases for determining value are employed, or if varying emphasis is placed on the factors considered when several or many factors are involved, as in the case cited above.[2] For one purpose emphasis may be placed on cost of reproduction new, but for another purpose the emphasis may be placed on cost to reproduce less depreciation, or upon actual cost. The allowance for depreciation would be nil in the first case, and might be either greater or less in the second case than in the third.

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[2] P. 420.

RESERVES VERSUS DEPRECIATION ALLOWANCE.—Since accounting is based on costs and the depreciation reserve is ordinarily set up to cover replacement cost of the plant at the same prices at which it was constructed, we may find it desirable to inquire into the relationship of such reserves, when correctly established according to approved accounting methods, to the allowance made for depreciation, according to, let us say, the cost-of-reproduction-less-depreciation basis. Clearly, cost of reproduction is not likely to be the same as was the actual cost of the plant upon the basis of which actual cost the reserves covering normal depreciation have been established. Assuming that this normal depreciation reserve in case of a well-settled plant is equal to 20 per cent of original cost of the plant and has been invested in extensions and betterments, and assuming also that cost of reproduction new is one and one-half times as great as the original cost of the plant, what deduction should be made from cost of reproduction new to secure the correct figure for cost of reproduction less depreciation? Should the deduction be the amount of the actual depreciation reserve, or one and one-half times its amount, or need not the amount of the deduction necessarily bear any direct relationship to the actual depreciation reserve which has been established?

With the exception of those who insist that repairs and depreciation are synonymous, the authorities agree that a deduction for depreciation should be made from cost of reproduction new but they are not all specific as to whether this deduction should be based on the cost of existing plant or on the estimated cost of reproduction. The physical fact of depreciation is clearly understood but when translated into terms of dollars and cents it is not always shown whether it is a percentage of actual cost or a percentage of estimated cost to reproduce.

CASES CITED.—In the *Knoxville Water Case,*[3] the United States Supreme Court said:

> The value of the tangible property found by the master is, of course, $608,000 lessened by $70,000, the value attributed to the intangible property, making $538,000. This valuation was determined by the master by ascertaining what it would cost, at the date of the ordinance, to reproduce the existing plant as a new plant. . . . The officers of the company, *alio intuitu,* estimated what they called "incomplete depreciation" of this plant (which we understand to be the depreciation of the surviving parts of it still in use) at $77,000, which is 14 per cent. of the *master's appraisement* of the tangible property. A witness called by the city placed the reproduction value of the tangible property at $363,000, and estimated the allowance that should be made for depreciation at $118,000, or 32 per cent.

In this instance the accrued depreciation is estimated as a percentage of cost of reproduction, not of original or actual cost. In *Re Salem Gas Light Co.,*[4] in 1911, the New Jersey Public Utility Commission fixed cost of reproduction new at $98,000 and then assumed that, on the basis of the theory used in the Cleveland Street Railway franchise agreement, accrued depreciation amounted to 30 per cent of this cost of reproduction, or about $29,400, which, the Commission declared, "should be carried on the books as a depreciation reserve, and deducted from the amount carried as surplus."

THE CORRECT THEORY.—These undoubtedly express the correct theory, namely, that the amount of depreciation should be represented as a given percentage of the cost of reproduction, not of actual cost. This is true because, for purposes of valuation, present values and prices are substituted for past values and prices. This plan abandons cost as shown in the accounts and substitutes figures which have no necessary relationship to original cost. Since this is true it follows that the *amount* of the depreciation reserve set up according to correct accounting principles bears no significant relationship to the *amount* of existing depreciation based on cost to reproduce new figures. This does not mean, however, that the existence or non-existence of such a reserve should have no weight in determining whether or not depreciation should be deducted from cost to reproduce new in determining what is fair value.[5]

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[3] 212 U. S. 1 (Jan. 4, 1909).

[4] Whitten, R. H., I, p. 370.

THE ACCOUNTING BASE.—Neither does this justify changing from a strictly cost basis in accounting for depreciation, either in case of utilities or of concerns engaged in competitive industry. That original cost is the correct basis, the answer to the following proposition will indicate: A machine cost originally $100 and must be replaced after ten years, at which time an identical machine can be purchased for $150. Should the depreciation be reckoned on the basis of original cost or of replacement cost? It seems clear that original cost ought to be the basis because to use replacement cost as a basis would permit the amortization of $150, whereas only $100 was invested. It would be presumptuous to assume that the original machine, which cost $100, took on during its lifetime an additional $50 in value merely because it will cost $150 to replace it. This greater cost is due to the increase in labor cost, cost of iron, etc., which in no way affects the original machine except possibly for selling purposes—usually a remote possibility. The additional $50 put in the new machine is an increase in the investment and should be charged to betterments. That rates ought to be increased to permit a reasonable return on such increases in the investment, is granted; but the increases in the investment should not be paid for by the consumers. Nor does this mean that increases in investment arising from community development, scarcity of land, etc., cannot be considered a part of the investment upon which a return may be allowed. It simply means that the consumer cannot be expected to furnish the additional investment, and also replace it and provide a reasonable return thereon out of his pocket.

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[5] See Chapter XIX.

Present value plus replacement fund—if it exists—may not equal or even approximate cost to reproduce, although it is sometimes assumed that it does. It ought not if wasting assets can be replaced only at increased cost, which increase should be represented by additional investment. Whether or not it does is of importance in making replacements rather than in making valuations. As stated in the *Metropolitan Reorganization Case,* the problem is not how to meet and provide for decrease in values, but what is the fair value of the plant at present.[6] Reserve funds may provide ultimate replacement even though capital remains impaired to a considerable extent in the meantime, which will occur unless the fund accumulates at least as rapidly as value disappears.

Appreciation

Appreciation occurs in certain classes of assets, and should be given due weight in valuations. The road-bed of a railway appreciates during the first few years, when it is necessary to make repairs on account of inequalities and defects resulting from sinking, sliding, etc., and these repairs are charged to operation, although they are really capital expenditures. Additions of earth and stone are required, and the road-bed slowly grows firmer and safer as the old material becomes more compact. Allowance may be made for this by entering the value due to adaptation and solidification under a separate head representing appreciation after operating begins.

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[6] *P. S. C. R.* (1st Dist., N. Y.), *Case No. 1305*, p. 155.

The Minnesota Commission allowed over 10 per cent of original cost for this item upon lines of the Northern Pacific aggregating over 1,500 miles; while upon lines of the Minneapolis Western Railway, with a mileage of 6.89 miles, it allowed but slightly over 1 per cent. The difference in the two cases was due to the better seasoning of the road-bed of the Northern Pacific. The Washington Commission says that appreciation continues about five years, when the value of the road-bed is approximately 10 per cent greater than when new.[7]

Depreciation and the Law of Averages

Those who determine depreciation allowances and those who are engaged in making valuations for purposes of rate-making, purchase, and so on, must base their policies upon recorded experience to a great degree. Several methods are in vogue for determining the annual depreciation allowance and for finding the normal depreciation in a plant, having given the necessary data. One is the straight-line method, which assumes that the rate of depreciation is constant from the time a unit begins to perform service until it is scrapped. Another is the sinking fund method, which is based on the assumption that the depreciation becomes gradually greater as useful life expires.[8] Both are arbitrary and there is no reason to suppose that they approximate actual conditions, although many illustrations of the use of each method may be found in important valuations which have met with the approval of the courts.

Under these circumstances it is natural to seek for some method of determining normal accrued depreciation in a plant composed of parts concerning which there is sufficient recorded experience to enable a really scientific estimate to be made. We are familiar with the work of actuaries and we know that they are able to determine the average length of human life by a study of the statistics of mortality. We know, too, that the average life of a given unit of physical property for a given climate and a given kind of service can be determined if we can secure sufficient statistical data on the experience of similar units of property used under similar conditions. The failure of facts to correspond with theory has resulted from the failure to use correct life averages in forecasting the useful life of wasting assets. This has led to the adoption of so-called minimum service values, ranging from, say, 5 to 25 per cent of cost new, below which it is assumed a unit of plant cannot fall so long as it is in service. This is unscientific and necessarily affects the accuracy of the results secured.

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[7] *Finding of Fact by the Railroad Commission of Washington Relative to the Valuation of Railroads,* p. 164.

[8] See tables and charts illustrative of these methods, in Chapters VII and VIII.

Law of Averages.—Statistics show that when large numbers are considered laws govern which are not evident from the observation of separate units. A few tosses of a coin may not indicate any definite tendency respecting heads and tails, but as the throws are increased it will be noticed that the number of heads tends to equal the number of tails. Likewise if we have data for, say, three freight cars, we may be able to draw no valuable conclusions therefrom regarding average life or the nature of the curve which it might be assumed would show the tendencies when thousands of freight cars are considered. Below is a table giving the results secured from 15,372 freight cars:[9]

Age	Per Cent of Freight Cars Surviving	Number of Freight Cars Surviving
0	100.0	15,372
1	99.8	15,341
2	99.6	15,310
3	99.3	15,264

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[9] Given by Edwin Kurtz in his valuable article, "Replacement Insurance," in *Administration*, July, 1921, p. 50.

Age	Per Cent of Freight Cars Surviving	Number of Freight Cars Surviving
4	99.1	15,234
5	98.8	15,187
6	98.4	15,126
7	97.9	15,049
8	97.3	14,957
9	96.1	14,772
10	95.0	14,603
11	94.0	14,450
12	92.3	14,188
13	89.6	13,773
14	86.5	13,297
15	83.6	12,851
16	79.5	12,221
17	74.5	11,452
18	68.4	10,514
19	61.3	9,423
20	51.4	7,901
21	41.0	6,303
22	32.4	4,981
23	23.7	3,643
24	16.7	2,567
25	10.8	1,645
26	6.4	984
27	3.4	523
28	1.3	200
29	0.3	46
30	0.09	14
31	0.04	6
32	0.00	0

These results are shown graphically in Form 12.[10]

The table and the graph show that when large numbers of freight cars are considered their lives tend to obey a certain law, just as human lives do. Experience with other kinds of equipment gives results which when shown graphically correspond in a remarkable degree to the results secured in case of freight cars. By a study of such graphs it is possible to learn what part of a given group of similar assets may be expected to be abandoned in any given year and thus to make calculations as to the amount of funds which will be needed to replace these assets as they are scrapped. Thus it is evident that abandonments do not occur with equal frequency over the period of thirty-two years representing the extreme life of a freight car, but occur most frequently at about the twentieth or twenty-

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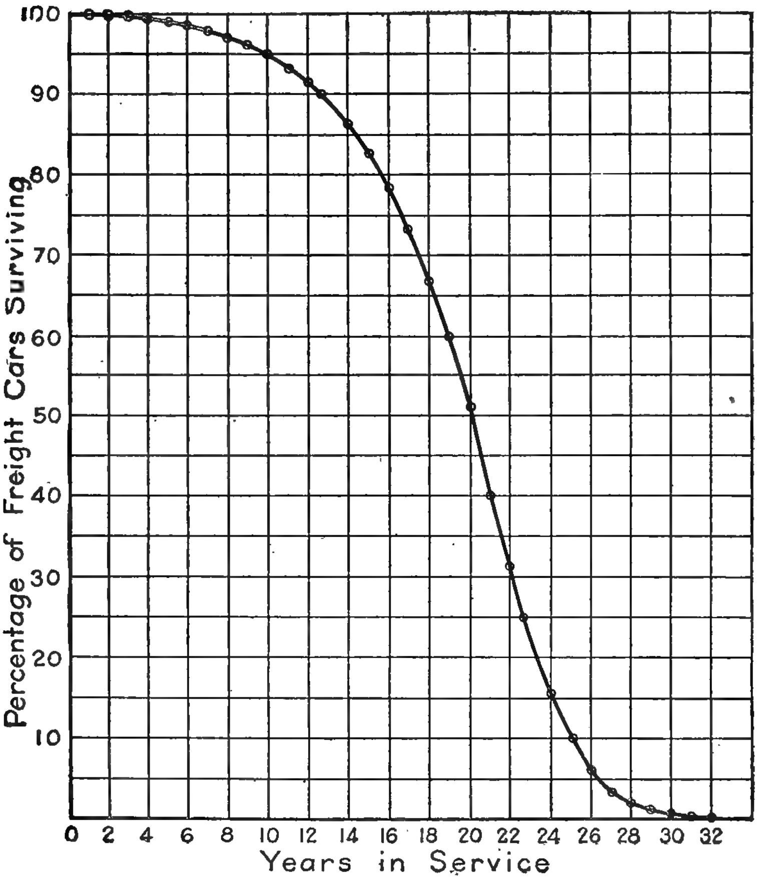
[10] Reproduced from *Administration*, July, 1921, p. 64.



Form 12. Summarizing Experience of 15,372 Freight Cars

second year. The greatest range between the percentages of freight cars surviving between any two consecutive years, as shown in the above table, is 10.4 per cent, this difference being the excess surviving in the twentieth year over that surviving in the twenty-first year.

MORTALITY TABLES.—This tendency to obey a certain law when large numbers are considered makes it possible to construct mortality tables for various classes of assets when sufficient data are collected. The Washington Railroad Commission has used such tables in its appraisal of freight cars, whereas in Michigan and Wisconsin estimates were made of the present value of each unit, over 40,000 freight cars being thus inspected in Michigan alone. If the average life of freight cars may be assumed to be twenty-five years, then the cars lose on an average about 4 per cent of their value each year. By multiplying the age in years by 4, the percentage of value which has expired is ascertained. This is then subtracted from 100, and the remainder shows what percentage the present value is of original cost or of cost of reproduction new, whichever base is used. Evidently to use this method we must know the date of construction and actual cost, when basing depreciation on actual cost.

It is sometimes maintained that mortality tables are rendered useless by the operation of obsolescence and inadequacy, which frequently cause the abandonment of property before it is worn out and therefore before its normal useful life has expired. Such abandonments are difficult or impossible to forecast. Whether or not this contention is well grounded depends upon what view we take of obsolescence. If, as the author believes,[11] obsolescence in case of going concerns is a cost of progress which should be capitalized and added to the cost of the property which displaces that which has become obsolete, then it does not invalidate the use of mortality tables. If, on the other hand, obsolescence is an expense which accrues during the period in which the units which become obsolete are being used, then it must be admitted that mortality tables are of little use in determining either depreciation rates or the amount of the depreciation which has accrued at any given time, for the simple reason that these are made dependent upon an unknown factor. Indeed, the attempt to make obsolescence a part of depreciation places the whole problem beyond the possibility of exact scientific treatment.

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[11] See pp. 22-34.

If obsolescence is capitalized as replacement cost then all depreciation rates can be based on normal useful life of plant. Whenever obsolescence becomes effective that part of the cost of plant which has not been amortized through the application of rates based on natural life should be regarded as a portion of the cost of the new part which replaces it. Unless this can be thus added to the cost of the new part and still enable production to be carried on at lower costs than when the old part is used, the old part is not obsolete.

Land in Valuations

Land, possessing some unique qualities, may be considered separately. It is not a wasting asset. Land normally appreciates, not through alterations in physical texture or arrangement, but because of scarcity, location, or the impossibility of duplication.

The wide variations in the results arrived at by experts in the valuation of land indicate the difficulty of the problem. The question of the unearned increment becomes of vital importance in public utility valuations, for upon the determination of the rightful owner of this increment must to a large extent depend the amount of the charges that may be asked. Under our present order of society this unearned increment belongs, rightly or not, to the fortunate possessor of land and may be regarded as a reward offsetting misfortunes in other directions. Nevertheless, there is a noticeable tendency to limit the amount of the rates that may be based on the unearned increment in the case of public utilities. Such limitation will presumably find its compensation in franchise privileges, monopoly, and right of eminent domain.

Whether or not land and appreciating land values ought to be considered in valuations depends on the purpose of the valuation. Where a public utility corporation possessed several tracts of land, it was held that only those actually and necessarily devoted to public use could be included for rate-making purposes. This despite the fact that rising land values may make it wise for the utility corporation to purchase lands that may not be "used and useful" in its service to the public for some time to come. The situation may justify such a purchase, but not the inclusion of the value thereof for rate-making, although it ought to be included in values for taxation.

ATTITUDE OF COURTS, COMMISSIONS, AND OTHER AUTHORITIES.—We have the authority of the Supreme Court of Minnesota in *Steenerson v. Great Northern Ry. Co.*,[12] that a railroad is entitled to earn a fair return on the cost of reproduction of its property; also the authority of the Supreme Court of the United States in *Willcox v. Consolidated Gas Co.*, that if property legally entering into the consideration of the rate question has increased in value since acquisition the company is entitled to the benefit of the increase; adding, however, that this is the general rule, and that there may be exceptions where the property may have increased so greatly in value that a rate affording a reasonable return upon such increased value may be unjust to the public.[13]

In *Louisville & Nashville R. R. Co. v. R. R. Commission of*

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[12] 69 Minn. 353 (1897). The same attitude is taken in the more recent case of *Shepard v. Northern Pacific Ry. Co.*, 184 Fed. 765 (1911).

[13] 212 U. S. 19.

Alabama,[14] a rate case, the court held that the company was entitled to realize upon the increased value of its lands, for the same reason that, should they be found to have depreciated in value, it would be compelled to bear the loss. "The law is perfectly settled, with the obvious view of the matter, that increments and losses alike attach to ownership as duties and rights attach to property." In his report in this case the special master said: "If values decline, the road is the loser; if they advance, the road is entitled to the benefit. So it is declared, and seemingly with justice." In *Municipal League v. The Pacific Gas & Electric Co.,*[15] the Arizona Corporation Commission said:

> The company's real estate holdings purchased in 1902 at a cost of $6,560 are listed by the company at $30,000. The testimony of real estate men as to the value of this property ranged from $15,000 to $26,000 as its present-day value. We are of the opinion that the company is entitled to appreciation upon its real estate, and the total value of the company's real estate as found by us is deemed the reasonable value and in harmony with the record.

LAND AT ACTUAL COST.—However, we have the authority of Commissioner Thelen of the California Railroad Commission[16] to the effect that land should be included at actual cost in valuations for rate purposes. In the case at issue land which had cost $43,400 nine years before was claimed to possess a value of $93,000, and Commissioner Thelen, after quoting from the decision of the California Supreme Court in its decision in *San Diego Water Co. v. City of San Diego*[17] to the effect that "it is the money reasonably and properly expended in the acquisition and construction of the works actually and properly in use for that purpose which constitutes the investment on which the compensation is to be computed," concluded that, "in logic and in justice, the public utility should receive a return on the moneys reasonably and properly expended in the acquisition and construction of its works actually and properly in use to carry out its agency—no more and no less."

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[14] 196 Fed. 800 (Apr. 5, 1912).

[15] 21 A. T. & T. Co. Com. L. 699 (June 23, 1913).

[16] *Application of North Coast Water Co.* to increase rates, 26 A. T. & T. Co. Com. L. 1161 (Dec. 3, 1913).

[17] 118 Cal. 556; 50 Pac. 633 (Oct. 9, 1897).

APPRECIATION AS OFFSET TO DEPRECIATION.—On the other hand, some authorities regard appreciation in land values as an offset to depreciation and development expenses, when determining whether or not anything shall be added for it in determining fair value. This was the attitude taken by Professor Bemis in his report on the rates of the Chicago Telephone Company. In his general discussion of this subject he said:

> How to treat the increase in land values, in a rate case like this, has been and still is a much disputed and unsettled question. The tendency of the courts has been toward the recognition of this increased value. Such has also been the practice of the Wisconsin Railroad Commission. On the other hand, the Massachusetts Gas and Electric Light Commission, which has, by far, the greatest age and prestige of any of our commissions, has always refused to recognize increase in the regulation of rates. It is held that only on the sale of such land can the company divide as a surplus the unearned increment, and it is not certain that even then the Massachusetts Commission would not compel the use of the proceeds of the sale in meeting needed extensions. . . .

The New Hampshire Public Service Commission has approved the statement of the court in *Consolidated Gas Co. v. City of New York*[18] to the effect that in ascertaining present value plus and minus quantities should be considered equally and appreciation and depreciation made to offset each other.[19]

In *Nashville, Chattanooga & St. Louis R. R. Co. v. United*

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[18] 157 Fed. 855.

[19] Whitten, R. H., II, p. 945.

States,[20] a case coming under the excise law of 1909, the United States Court of Appeals, Sixth Circuit, decided that loss in value in the separate units of roadway may be offset by appreciation in other units. It was found that repairs, renewals, and replacements offset any depreciation and therefore no allowance was granted for it.[21]

LIMITATION ON APPRECIATION.—It is the belief of the Minnesota Railroad and Warehouse Commission that if railroads are permitted to realize on continually increasing land values by employing them as a basis for computing returns, they will ultimately absorb a disproportionate share of the country's wealth.[22]

Thus there appears to be a limit to the growth of values upon which a public service corporation is entitled to what is called a fair return. There is a common tendency on the part of courts and commissions to place a limitation upon increasing values for rate-making purposes. The Interstate Commerce Commission faced this question in its investigation of advances in rates by carriers in western trunk line territory.[23] Railway officials declared that they possessed a "legal right" to a fair return, not on the original investment, but on the estimated present value, resulting largely from increase in land values and amounting to many millions of dollars. Admitting the great services of the railroad to the State, the Commission asked whether larger income should not be derived from increased traffic rather than from heavier tolls on those already served. Public service corporations do business with the expectation of deriving an income from services rendered to the public, not from investments in land whose value happens to be increasing. Whatever may be the true economic or legal view on the right of a carrier to earn a reasonable return on the increased value of its land, says the Commission in substance, such an increase does not of itself afford the basis for an increase in rates upon a given service. This may be interpreted as leaving the question unsettled, since average rates may be made to furnish a fair return on increased values even though certain specific rates do not.

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[20] Decided Dec. 7, 1920. Bureau of Internal Revenue Ct. D. 4, 6-21-1433.

[21] The Act of August 5, 1909, allowed as a deduction "a reasonable allowance for depreciation of property." (36 Stat. 11; 112 C. 6.)

[22] *Supplement to Annual Report, Nov. 30, 1908,* pp. iv-v.

[23] *Opinion No. 1509* (decided Feb. 22, 1911).

Land Distinguished from Other Assets.—Some authorities make a very definite distinction between land and other assets because it always possesses a market value which differentiates it from other property. For this reason Chairman Stevens of the New York Commission, Second District, maintains that "it has been universally held that a company is entitled to a just and reasonable return upon the present value or market value of land used by it in the public service." [24] Likewise the St. Louis Public Service Commission appraises land at present market value while appraising equipment at actual cost. It says: [25]

> It has been stated above that the greater part of equipment has no measurable present "value" (other than scrap or second hand) separable from the earning power of the whole plant, but with land the case is entirely different. Land generally has a present value distinct from its use in a public utility. This value is what it might be expected to bring at a sale under ordinary conditions and will approximate the value of contiguous property.
>
> In fact "commercial land" is almost a cash item at its present sale value. The company could supposedly realize this amount in money; but refraining from doing so and keeping the amount in the service of the public, it seems but just that this present value should be the amount upon which it should be allowed to earn reasonable returns. The

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[24] *Fuhrmann v. Cataract Power & Conduit Co.,* 3 P. S. C. 2d D. (N. Y.) 656 (Apr. 2, 1913).

[25] *Report to Municipal Assembly of St. Louis on Southwestern Telegraph and Telephone Co.,* Oct. 14, 1913.

> Commission believes that the value assigned to commercial land in this case should be its appraised present value in the market and has used this appraised value in building up the amount upon which it considers this company entitled to earn a reasonable return from the Public.

APPRECIATION NOT INCOME.—The Wisconsin Commission has held that appreciation should not be regarded as an offset to depreciation in determining the yearly depreciation charge.[26] This Commission has also held that where present value of land is less than cost present value must govern in determining fair value for rate purposes.[27]

APPRECIATION AS INCOME.—The appreciation of land values is sometimes considered in the same light as depreciation of other assets. The United States Circuit Court in *Consolidated Gas Co. v. City of New York*[28] in considering this matter says that appreciation and depreciation should be considered alike, and in expanding upon this principle the New York Public Service Commission, First District,[29] says that the only difference is that while depreciation is a loss to be debited, appreciation is a profit to be credited, since it represents an increase in assets. The Commission thinks that if land is taken at its depreciated value when it has depreciated, it is only fair to take it at its appreciated value under opposite conditions. To accomplish this it is suggested that an entry be made in the estimated receipts equal to average annual appreciation; otherwise, while the consumer is burdened with the depreciation of all other items, he will not receive any benefit from the appreciation of the land.

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[26] *City of Milwaukee v. Milwaukee Electric Railway & Light Co.*, 11 W. R. C. R. 1 (Aug. 23, 1912).

[27] *Superior Commercial Club v. Superior Water, Light & Power Co.*, 11 W. R. C. R. 704 (Nov. 13, 1912).

[28] 157 Fed. Rep. 855.

[29] *Re Gas and Electric Rates of the Queens Borough Gas and Elec. Co.*, 2 P. S. C. R. (1st Dist.), June 23, 1911.

Appreciation is in fact realized as income whenever a company is permitted to earn a fair rate on an increased valuation even though the appreciated value itself is not taken into the books as income. However, this is not the same as considering the appreciated value of the land as income. In *Kings County Lighting Co. v. Willcox,*[30] the Appellate Division of the New York Supreme Court reversed the order of the New York Public Service Commission, First District, to the effect that the average annual appreciation in land values should be considered income and thus offset the effects of appreciating value of land in determining rates. The court had the following to say:

> This we regard as erroneous. The land is used for the business of the company and is appropriate therefor. So long as the land is held and used for such purpose increase in value can not be considered as income or as available for the payment of debts, taxes or dividends.

This was approved by the New York Court of Appeals in 1914, which said, "We agree with the Appellate Division that annual increase in the value of land is not income."

USE OF MULTIPLES TO DETERMINE REPRODUCTION COST.—The cost-of-reproduction method of valuing land has on certain occasions been given an unusual interpretation. Railroad officials have argued that land owned by their companies ought not to be valued at present market value, because the railroads, were they actually to buy the lands, would pay more than market value. So this additional cost is added to market value to determine cost to replace. That railroads do pay exorbitant prices for land is well known. This is because of injury resulting to contiguous property, and because land-owners sometimes look with disfavor upon the projected road and take the opportunity to fleece the company.

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[30] 156 App. Div. 603 (May 9, 1913).

If land is valued on this basis, a certain multiple of market value must be taken to arrive at reproduction cost. In Minnesota, investigation of a section of the Illinois Central indicated that of 35 per cent of the right of way secured by condemnation the company paid about 4½ times average true value, while of the 65 per cent purchase by agreement the price was 1.7 times average true value. Terminal lands in St. Louis cost 1¾, in Minneapolis 1 3/5, and in Duluth 1¼ times normal value.

But when allowance has been made for actual excessive cost of land to railroads, it does not necessarily follow that they may write up these lands by the same multiple above *present* market values. Value as utility may be a more important consideration than reproduction cost in some cases, and, for rate-making purposes at least, extremely high valuations of property cannot be accepted merely because it could not be reproduced, or, if it could, only at very high prices. To establish original cost the railroad multiple should be used; also to establish cost of reproduction, and appreciation. But full cost of reproduction may not be allowed as a basis for rates.[31]

Justice Hughes, in delivering the opinion of the Supreme Court of the United States, June 9, 1913, in the *Minnesota Rate Cases,*[32] apparently upholds the stand taken by the Interstate Commerce Commission in the railroad rate cases already considered. Declaring the cost-of-reproduction method inapplicable in the case in hand because of the conjectural results that would be secured, he asks whether in determining the fair present value of a railroad company's property as a basis for rates it is proper to value its right of way in excess of the market value of contiguous property similarly situated, i.e., whether such an increment of value is to be added as will not only cover increase in value resulting from the activities and prosperity of the community, but will constantly outstrip such increase in all neighboring lands.

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[31] See Chapter XIX.

[32] *Simpson et al. v. Shepard; Same v. Kennedy; Same v. Shillaber;* 230 U. S. 352.

The court concludes that the increased valuation to be permitted should not exceed average normal increase of other land in the community.[33] In the *Alabama Railroad Rate Cases* the reproduction-cost method was followed in valuing land, but no special "railway" value was allowed. In the *Central Georgia Case* the special master said: [34]

> . . . The right of way acreage has a fixed value in the market, and the fact that in acquiring it at such fixed market value the railroad company is compelled to pay a further sum for its acquisition, not because such further sum is any part of the actual value, but merely because by the acquisition of the right of way other property not acquired is damaged, and such damages must be paid for, or because such further sum is necessary to be paid over and above acreage value because it is a railroad company making the purchase, adds nothing whatever to the actual acreage value, which last-named value alone is to be considered in estimating the present value of the property devoted to the public use.

He adds, however, that it is proper to note that excess costs resulting from damage done to property not taken or from the excessive costs that railroads are compelled to pay for other reasons have been recognized by some courts and some railroad commissions, and have been recognized as constituting a portion of value for rate-fixing purposes, and quotes from *Shepard v. Northern Pacific Railway Co.*[35] (1911), to the effect that:

> Every railroad company is compelled to pay more than the normal market value of property in sales between private parties for the irregular track it needs and acquires for rights of way, yards and station grounds. . . . The

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[33] See extracts from this case, p. 346.

[34] Report of W. S. Thorington, Special Master, Jan. 8, 1912.

[35] 184 Fed. 765.

> measure of the value of real estate is its market value for its most available one.

In *Chicago & Northwestern Railway Co. v. Smith*,[36] on the authority of the *Minnesota Rate Cases*, the district court rejected the master's report recommending a valuation determined by multiplying the market value of adjacent land by 2½, and reduced the valuation from $3,449,826 to $1,377,960, by the elimination of multipliers.

The California Railroad Commission in ascertaining the reproduction value of the property of the Stockton Terminal and Eastern Railroad Company[37] multiplied market value by 1.5. This finding was dated April 30, 1913, but the valuation was made for no specific purpose. On June 9, 1913, the *Minnesota Rate Cases* were decided. On July 29, 1913, the California Commission, in commenting[38] on this decision, which rejected the use of multiples, said:

> There is much reason in support of this ruling. The unearned increment of land is growing so rapidly that if public utilities in rate-fixing inquiries were allowed not merely the fair average market value of similar lands in the vicinity, including the unearned increment, but also multiples in addition thereto, rates might soon go so high that it would be impossible for the public to pay them. It may well be that in rate-fixing inquiries which may hereafter come before rate-fixing bodies, both state and national, justice to the public may demand that the basis of return on real property shall be less even than the "fair average market value of similar land in the vicinity," including the unearned increment. If we bear clearly in mind the distinction between a fact, namely, the cost of reproducing real estate, and the entirely distinct matter of ascertaining the proper basis for fixing rates in any particular case, we shall not be led astray. As I am finding facts in this case,

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[36] 210 Fed. 632 (Jan. 20, 1914).

[37] 2 Cal. R. R. C. 777 (Apr. 30, 1913).

[38] 3 Cal. R. R. C. 22 (July 29, 1913).

> and not saying how they should be applied in a rate-fixing inquiry, I find that the operative real property owned by the railroad company in this proceeding based on the "fair average market value of similar land in the vicinity," is the sum of $5,187 and that the cost to reproduce said property is the sum of $5,682.

Multiples were also rejected in the New Jersey appraisal made for tax purposes in 1911.[39]

The special committee on valuation of the American Society of Civil Engineers stated that the present value of the land ought to be based upon actual cost plus subsequent appreciation. This appreciation is to correspond to that of surrounding property; but if the valuation cannot be made in this way the land is best valued on the basis of current prices of neighboring land of similar character, increased by the ratio ordinarily existing in that section between land bought by public service corporations and that purchased by private parties. Furthermore, the land is to be subject to the value of improvements existing upon it when it was purchased, such improvements to be valued at current prices.[40]

Sales Method

The so-called "sales method" of determining present value has its uses and limitations. It is based on the assumption that as the assessed valuation of surrounding properties is to real value, so the assessed value of the property in question is to its real value. Thus, if land in a city is assessed at 60 per cent of selling price, and a railroad buys 40 acres of land within the city limits for $12,000, the same land being assessed at $6,000, then the normal selling value would approximate $6,000 ÷ .60, or $10,000. So the railroad paid $2,000 above normal. The efficacy of this method is dependent on two conditions: (1) a sufficient number and variety of transfers to afford an accurate statement of average values, and (2) the equity of the assessed valuations. But inequality of assessment is notorious, and it seems that the method can be employed only within rather narrow limits and then may well be checked up with any other available information concerning the property in question.

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[39] See p. 404.

[40] *Report of the Special Committee*, p. 52.

APPENDIX

APPENDIX A

DEPRECIATION OF OIL AND GAS EQUIPMENT

The following data are taken from the *Manual for the Oil and Gas Industry*, pp. 62-71:

> Depreciation deductions are to be charged to a reserve fund, and are in addition to any regular charge for repairs and operating maintenance.
>
> No consideration has been given exceptional cases where premature failure of supply or market may materially reduce the given life of the facility. Such cases are necessarily exceptional and will receive special consideration, as provided for in the regulations. (See Regulations 62, art. 225.)
>
> ### CLASS A, NO. 1.—DRILLING EQUIPMENT
>
> This includes engines, boilers, rig irons, and portable derricks.
>
> It is recommended that four years' life be allowed to equipment as a whole, depreciated at the following rate:
>
> | | Per Cent |
> |---|---|
> | First year | 40 |
> | Second year | 25 |
> | Third year | 15 |
> | Fourth year | 10 |
> | | 90 |
> | Salvage | 10 |
> | | 100 |
>
> Permanent derricks, rig irons, boilers, and engines left at the well are included under "Well equipment."
>
> Drilling tools (cable and rotary), and fishing tools are included under "Tools"—Class A, No. 5.
>
> ### CLASS A, NO. 2.—WELL EQUIPMENT
>
> As most equipment of a producing well *has no separate value apart from the well,* it is suggested that all wells and their equipment

be depreciated at the same rate as the wells are *depleted,* using the same curve rate for both; but if the life of the physical equipment is greater than the life of the deposit, then the depreciation rate of the physical equipment will be governed by the reasonable expectation of the life of the deposit.

If the life of the equipment is shorter than the life of the well, then replaced equipment should be charged against maintenance and operation.

This method proved satisfactory in the appraisements of the Independent Oil Producers Agency of California, embracing some 130 companies, and is generally acceptable to all operators who have been consulted in the matter.

CLASS A, NO. 3.—DEHYDRATORS

These are either of electric, pipe, or tank type. The life of the pipe and tank dehydrators is very erratic as these burn out quickly with practically no salvage. It is recommended that this type of equipment have a straight line depreciation as follows:

	Life *Years*	Depreciation Per Annum *Per Cent*
Electric	5	20
Pipe	2	50
Tank	2	50

CLASS A, NO. 4.—TANKS

The following depreciation rate for tanks is recommended:

	Life in Years	Per Cent
Steel, 5,000 to 55,000 barrels	20	5
Steel, 2,500 to 5,000 barrels	12	8⅓
G. I., 500 to 2,500 barrels	12	8⅓
G. I., less than 500 barrels	8	12½
Wood	5	20
Movable tanks:		
G. I., 500 to 2,500 barrels	9	11⅑
G. I., less than 500 barrels	6	16⅔
G. I., water tanks, 500 to 2,500 barrels	8	12½
G. I., water tanks, less than 500 barrels	5	20

These results may be used for all classes of service—that is, oil producing, refineries, etc.

CLASS A, No. 5.—TOOLS

This includes standard, rotary, and fishing tools. While rotary equipment may be shorter lived, it is, in general, offset by the standard tool equipment which will have a life of at least four years in many cases.

Owing to the excessive wear and tear and losses on such equipment an average life of three years is recommended, using an annual depreciation rate of 33⅓ per cent.

CLASS A, No. 6.—TRANSPORTATION EQUIPMENT

All transportation equipment, such as motor trucks, autos, wagons, horses, and harness, can be placed at a three-year life or an annual depreciation rate of 33⅓ per cent.

In fact, the average life of automobiles is less than three years. The percentages of cost for horses, harness, and wagons is such that they can be grouped with three years' life, disregarding salvage value.

CLASS A, No. 7.—WATER PLANTS

Considering the water well, pump, steam power, gas and oil power, and electric power as a class, they may be given a useful life of approximately 10 years, allowing a straight depreciation rate of 10 per cent.

CLASS A, No. 8.—ELECTRIC EQUIPMENT

In considering electrical equipment, one may include the separate items of generators, motors of various sizes, transformers, wiring (both indoor and outdoor), power lines, and switchboard.

As oil-well motors are not suitable for other uses and as the class of wiring usually done on leases is not up to utility company standards, it is recommended that a combined life on electric equipment be placed at 10 years, allowing a depreciation rate of 10 per cent.

CLASS A, No. 9.—MACHINE SHOP

In covering machine shop there is included wood buildings, power tools, blacksmith tools, small hand tools, shafting, and shop power, which will, on an average, have a seven-year life or a depreciation rate of 14²⁄₇ per cent. The smaller hand tools, of course, may have a life of not more than two years, but their cost is not important and the depreciation rate is lowered by the longer life of more expensive items, such as power tools, wood buildings, shafting and power equipment.

CLASS A, NO. 10.—BUILDINGS

Buildings are grouped into four general classes:

No. 1. Wood, which includes small dwellings, small outhouses, small warehouses, small power plants, and small platforms which are built on the ground. These have an average life of 10 years, which allows a depreciation rate of 10 per cent.

No. 2. Frame buildings, placed on brick or concrete foundation with siding and shingle or patent roof painted, have an average life of 15 years or a straight line depreciation rate of 6⅔ per cent.

No. 3. Corrugated iron siding, renewable, has a life of six years or a depreciation rate of 16⅔ per cent.

No. 4. Concrete, brick, and steel frame have an average life of 25 years or an annual depreciation rate of 4 per cent.

The permanent buildings may outlast the remainder of the plant, hence have no salvage value. Gulf Coast fields may claim shorter life for iron buildings because of salt air conditions.

CLASS B.—PIPE LINES

Pipe lines are subdivided into main line, pump stations (which include all equipment such as engines, pumps, boilers, etc.), auxiliary equipment, buildings, telephone and telegraph, and terminal facilities.

It is recommended that—

Mains 6 inches or over in diameter be based on a 20-year life or an annual depreciation rate of 5 per cent.

Mains under 6 inches diameter be based on a 16-year life or an annual depreciation rate of 6¼ per cent.

Gathering lines be based on a 10-year life or an annual depreciation rate of 10 per cent, with a salvage of 10 per cent.

Pump stations, including all equipment, telephone lines, and terminal facilities based on a life of 10 years, or an annual depreciation rate of 10 per cent.

These conclusions were reached after carefully considering detailed data in which it was decided that pipe lines could be grouped into the subdivisions given above.

The subject of electrolysis in pipe lines has been investigated and the losses have proved to be very small and negligible in comparison with the amounts invested, so far as making any special allowances in depreciation.

Below is given the result of a pipe line 220 miles long, having 16 stations and costing \$3,906,668.

	Cost	Per Cent of Total Cost	Life in Years	Weight
Right of way	\$ 83,176	2.2	20	0.44
Ditching	497,358	12.7	20[1]	2.54
Pipe	1,323,901	33.9	20	6.78
Steel storage	426,047	10.9	20	2.18
Buildings	246,651	6.3	20	1.26
Total	\$2,577,133	.....	....	.....
Machinery:				
Pumps	\$ 260,108	6.7	14	.94
Boilers	136,356	3.5	10	.35
Heaters	30,341	.8	10	.08
Miscellaneous (freight, etc.)	88,937	2.3	8	.18
Total	\$ 515,742	.....	....	.....
Wiring	\$ 8,060	.2	10	.02
Fittings	151,725	3.9	7	.27
Commissary	270,782	6.9	10	.69
Telephone lines	85,905	2.2	10	.22
Spurs, loading racks, etc.	14,276	.4	5	.02
Sundries (tools, paints, water wells, etc., superintendence, supervision)	283,045	7.2	5	.36
Total	\$1,329,535	100.1	....	16.33[2]
Grand total cost	\$3,906,668	.....	....	.....

[1] Same as pipe.

[2] Average life in years.

Class C.—Tank Cars

This class of equipment is of very stable construction, and it would appear that the maximum 20-year life can be accorded and a 5 per cent per annum depreciation established.

Class C.—Refineries

In order to arrive at a depreciation figure for the refinery as a whole, it is necessary to determine the relative investment in each item of equipment as compared to total investment. The various items have been grouped into classes that have about the same rate of depreciation, and the depreciation for the whole plant calculated by multiplying each item by its rate of depreciation.

Refineries were divided into two classes, skimming plants and complete refineries—that is, refineries equipped with lubricating plants (but not having cracking plants). Figures for relative investment in each class of equipment were obtained from reports on valuation of refineries and from Department estimates.

Calculated depreciation for whole refinery

(*a*) COMPLETE REFINERY

	Per Cent of Total Investment	Rate of Depreciation	Product
Equipment:	*Per Cent*	*Per Cent*	*Per Cent*
Distilling equipment (stills, condensers, agitators, etc.)	25	15	3.8
Power plant (boilers, engines, electrical equipment, etc.)	15	10	1.5
Buildings	10	5	.5
Storage (all kinds)	25	8	2.0
Pipes and fittings	10	12	1.2
Lubricating plant (filters, presses, chillers, grease plant, etc.)	10	10	1.0
Miscellaneous (* * * loading racks, machine shop, laboratory, etc.)	5	10	.5
Depreciation on refinery as a whole	....	....	10.5

(*b*) SKIMMING PLANT

	Per Cent	*Per Cent*	*Per Cent*
Distilling equipment	35	15	5.3
Power plant	10	10	1.0
Buildings	5	10	.5
Storage	35	8	2.8
Pipes and fittings	10	12	1.2
Miscellaneous	5	10	.5
Depreciation on refinery as a whole	....	....	11.3

Refineries can also be classed according to their location into three general classes and should be given rates of depreciation accordingly. The three classes and suggested relative depreciation are as follows:

	Useful Life *Years*	Deprecia-tion Rate *Per Cent*
Well-constructed refinery plants located on the Atlantic coast or Gulf coast or at points that are assured of a supply so long as there is production east of the Rocky Mountains or from Mexico..................	20	5
Refinery plants of good construction located on trunk pipe lines or where a supply of crude is assured for several years	10	10
Skimming plants and small refineries of poor construction or located at points where the supply of crude is not assured for a long period of time.............	6	16⅔

It is suggested that the last named be depreciated according to the decline curve of the oil field supplying the oil.

The estimates of the total depreciation were based on what was considered the normal life of the plant, and no conditions that were purely local were taken into consideration. However, in making any depreciation charge the relation of the location must be taken into account. Such things as the supply of raw material, removal of market, climatic conditions, soil conditions, and the nature of the raw material are points brought out by local conditions.

Plants situated on pipe-line terminals and those on the seaboard that can be fed by tankers and pipe lines have an advantageous position. Plants in the midst of an oil field relying solely on that field for crude supply have a length of life depending on the life of the field. Plants on pipe lines controlled completely or in part by the company owning the plant are in much better shape than those dependent on a rival company for their supply of crude.

A plant is subject to the removal of its market in whole or in part when it is situated a great distance from that market and is confronted with a new plant or competitor adjacent to the market that is able to undersell the products of the distant plant. The foreign market may be completely removed through the growth of new oil fields and competitive tariff conditions.

Any abnormal rate of depreciation due to the chemical nature of the soil causing ironwork to deteriorate rapidly must be considered. Conditions of high humidity shorten the life of ironwork and brickwork.

High sulphur crudes cause stills and condensers to deteriorate rapidly. Crudes containing salt, other solid or colloidal matter, and those carrying a high content of water and foreign matter cause a shorter life for general refinery equipment.

An agreement must be reached between the Treasury Department and the refiners in cases for special districts as to just how much extra depreciation they should be allowed for a condition that is peculiar to their territory.

The total general depreciation that is allowed takes in the skimming plants and so-called complete refineries that have a lubricating plant. For plants that have a complete refinery and in addition cracking plant, certain extra depreciation charges must be allowed. In many cases the cracking plant is as much as one-tenth the total plant investment and should be given a shorter life than the average plant's life.

CLASS D.—SALES OR MARKETING EQUIPMENT

Sales or marketing equipment is summarized in the following table:

	Life for Depreciation *Years*	Annual Depreciation Rate *Per Cent*
Tankers: Where such have been bought or built during the war period, that the cost be written off to $125 per D. W. ton and at that rate	20	5
Barges, harbor tugs, or other small floating equipment	5	20
Filling stations:		
(1) Ordinary wood or corrugated construction	5	20
(2) Brick and concrete, or extraordinary construction	10	10
Distributing stations	10	10
Tank wagons:		
Motor type	4	25
Horse type	6	16⅔
Steel barrels	7	14²⁄₇
Tracks and switches	8	12½

In considering depreciation on filling stations the factor to be given the most consideration is location. The normal life of equipment and buildings is at least 10 years, but unless the station is favorably situated it may last only 2 or 3 years.

NOTE.—Filling stations are divided into two classes: (*a*) Stations that have temporary wooden or corrugated iron buildings; and (*b*) stations that have buildings of brick or terra cotta, where the investment in buildings represents a large percentage of the total investment.

Distributing stations with exception of delivery equipment do not depend to such a large extent on location, and for that reason are given a longer life, although if delivery equipment is taken into consideration the depreciation rate for the whole plant would no doubt be higher than for filling stations. Delivery equipment, such as tank wagons, horses, trucks, etc., constitute a large percentage of the investment in distributing stations and are short lived; therefore, in calculating depreciation on distributing stations the relative investment in warehouse equipment and in delivery equipment must be taken into consideration.

The rate of depreciation on tank cars is the same as that given under refinery equipment. In considering selling and transportation equipment the investment in tank cars is really a special item, inasmuch as a large number of marketers do not own any tank cars at all.

The same thing applies to marine equipment, since only the large companies that do an extensive export business possess marine equipment. It is believed that an average depreciation rate of 10 per cent or a life of 10 years will cover this class of equipment, since equipment such as bulkheads, docks, etc., have a life of only 4 to 6 years, while floating equipment, such as tankers, will easily last 20 years.

Class E.—Natural Gas—Utility Companies

The drilling equipment and well equipment of natural-gas companies should be depreciated at the same rate as drilling equipment and well equipment for oil wells, previously given.

The following depreciation rates are suggested for gas pipe lines:

	Per Cent
Mains	8⅓
Gathering lines	10
City lines	10
Compressor stations, including gas compressors, engines, boilers and boiler equipment, should be grouped into one heading and depreciated at an annual rate of	$14\frac{2}{7}$
Gathering stations	16⅔
Field stations	25
Meters and regulators	20

The information at hand in which the cost of the equipment was taken into account showed that a natural-gas plant could be depreciated, as a whole, at a rate of 10 per cent. It is a general consensus of opinion that the average life would not be over 10 years.

It is recommended that conditions existing on January 1, 1916, be used as a basis, and that all expenses incurred to maintain the output or carrying capacity of lines, as of that date, be treated as follows:

That intangible expenses may be charged direct to maintenance as an operating expense.

That tangible items be charged to investment or capital account and should be given a 25 per cent salvage value and the remaining 75 per cent charged off at the rate of 17½ per cent per annum for all gas properties other than those in West Virginia, Pennsylvania, and possibly Ohio, where the natural-gas plants, as a whole, should be given a 15-year life, and the extensions figured on a 7-year life on a 15 per cent salvage, and the remainder charged off at the rate of 12 per cent per annum.

The above conclusions are based upon a 7-year life for gas fields in West Virginia, Pennsylvania, and possibly certain portions of Ohio, and on a 4-year life for all other gas fields.

The shorter life for the other gas fields can be substantiated by numerous examples, such as Southern Kansas, Hogshooter, Cushing, and Pawhuska fields, all of which were large producers and were all practically exhausted within five years, but the bulk of the gas was taken out during the first three years.

CLASS F.—NATURAL-GAS GASOLINE PLANTS

Compression plants may be divided into compressors, engines, boilers, auxiliary equipment, cooling equipment, gathering and distributing lines, blending tanks, buildings, and electrical equipment.

For absorption plants, separate items of absorbers, stills, condensors, cooling equipment, auxiliary equipment, boilers, engines, electrical equipment, tanks, and loading racks may be considered.

On the whole the average life of these plants is not over five or six years.

In consideration of these data and other data at hand, it is recommended that:

The original cost be placed on a 20 per cent salvage, and the remaining 80 per cent be depreciated on the basis of 6 to 10 years' usefulness of plant, or on the actual known life of wells producing gas.

Summary

Class	No.	Reference		Useful Life	Annual Depreciation
		Page		*Years*	*Per Cent*
A.	1	63	Drilling equipment	4	40–25–15–10
	2	63	Wells	....	....
	3	63	Dehydrators:		
			Electric	5	20
			Pipe and tanks	2	50
	4	64	Tanks:		
			Steel 5000–55000 bbl.	20	5
			2500–5000	12	8 1/3
			Galvanized-iron 500–2500	12	8 1/3
			Less than 500	8	12 1/2
			Wood	5	20
			For movable tanks:		
			Galvanized iron 500–2500	9	11 1/9
			Less than 500	6	16 2/3
			For water tanks:		
			500–2500	8	12 1/2
			Less than 500	5	20
	5	64	Tools	3	33 1/3
	6	64	Transportation equipment	3	33 1/3
	7	64	Water plants	10	10
	8	64	Electric equipment	10	10
	9	65	Machine shops	7	14 2/7
	10	65	Buildings:		
			Small wood	10	10
			Frame structure	15	6 2/3
			Corrugated-iron siding	6	16 2/3
			Concrete	25	4
			Brick	25	4
			Steel	25	4
B.	1	65	Pipe lines: Less 10 per cent salvage.		
			Mains over 6 inches diameter	20	4 1/2
			Mains under 6 inches diameter	16	5 5/8
			Gathering lines	10	9
			Pump stations	10	10
C.	..	66	Tank cars	20	5
	1	66	Refineries:		
			Class 1.—Located at point assuring a long supply of crude oil; or well-constructed plants.	20	5
			Class 2.—Located at points assuring supply of crude oil for several years.	10	10
			Class 3.—Skimming plants and small refineries of poor construction, or located at points where supply of crude oil is not assured for a long period of time.	6	16 2/3
D.	1	68	Sales or marketing equipment:		
			Tankers	20	5
			Barges	5	20
			Filling stations—		
			Class A.—Ordinary wood or corrugated steel construction.	5	20
			Class B.—Brick and concrete or extraordinary construction	10	10
			Distributing stations	10	10
			Tank wagons—		
			Motor	4	25
			Horse	6	16 2/3
			Steel barrels	7	14 2/7
			Track and switches	8	12 1/2

SUMMARY—Continued

Class	No.	Reference		Useful Life	Annual Depreciation
		Page		*Years*	*Per Cent*
E..........	..	69	Natural gas (utility companies):		
	1		Drilling equipment. (See A-1.)		
	2		Wells. (See A-2.)		
	3		Gas pipe lines—		
			Mains	12	8½
			Gathering lines	10	10
			City lines	10	10
	4		Compressor stations	7	14¾
	5		Gathering stations	6	16⅔
	6		Field stations	4	25
	7		Meters and regulators	5	20
			Considered as a whole plant	10	20
F..........	1	70	Natural-gas gasoline:		
			Plant—Compression, with 20 per cent salvage value	6–10	13⅓ to 8
			Absorption plants, with 20 per cent salvage	6–10	13⅓ to 8

APPENDIX B

DEPRECIATION AND INTERSTATE COMMERCE COMMISSION RAILROAD VALUATION

Following is the engineering board memorandum No. 226 (as revised November 6, 1915) incorporated in *I. C. C. Valuation Docket No. 2.* Texas Midland Railroad.

SUBJECT: *Depreciation of road and equipment property.*

The board is of the opinion that the principles contained in the following definitions should govern in determining the depreciation of physical property used for common-carrier purposes:

(1) Depreciation is the lessening in worth of physical property due to use or other causes.

(2) Labor depreciates with the items of property of which it is a part.

(3) Service-condition per cent is the ratio between remaining capacity for service and total capacity for service in each *cycle of use.*

(4) Depreciation shall be determined by a consideration of observations of actual conditions of the property and mortality statistics of similar property in like use applied where practicable on the straight-line basis.

(5) Salvage is the net value which an article possesses for carrier purposes other than that for which the article was originally used.

(6) Scrap is the net market value which an article possesses after its service for carrier purposes has been exhausted.

(7) Normal life shall be the estimated average total service life under ordinary conditions.

When depreciating property under the several accounts, the following general rules shall apply:

> (*a*) Ordinarily, service-condition per cent shall be the ratio between the remaining service life and the total service life. When the depreciation of an item of property is based upon the weighted

average of the parts, the service condition of each part shall be determined by this ratio.

(*b*) When a normal life for a particular item of property has been prescribed for use in determining depreciation, that life must not be departed from unless an investigation of the records of the carrier or actual inspection in the field, or the two combined, warrant such departure. In no case shall a remaining service life of an item of property be taken at more than the prescribed normal life.

(*c*) When no normal life is prescribed, the total service life and remaining service life shall be determined from observation of actual conditions and the examination of records and data from reliable sources.

(*d*) *Salvage* and *scrap* will be allowed in cases where such values actually exist. Whether allowance shall be made in a given case for salvage or scrap shall be left to the discretion of the member of the engineering board. If an allowance is made, this fact shall in all cases be stated upon the pricing sheet, even though at the time the amount of the allowance can not be given.

(*e*) The service-condition per cent as stated in the field record by the field man shall be subject to revision and final fixing by the member of the engineering board or his staff subordinates. The service-condition per cent fixed in the field is assumed to be simply the statement of a fact.

ACCOUNT 1. ENGINEERING

A small portion of the expenditure for engineering is connected with property which depreciates. In view of the fact that the larger portion is expended on location surveys, grading, and other property which does not depreciate, and that the accounting records have been so kept in the past as to make it impracticable to segregate that portion of the expenditure which depreciates, the service-condition per cent of the account shall be considered at 100.

ACCOUNT 3. GRADING

No allowance shall be made for appreciation or depreciation, as such, to excavation and embankment pay quantities of grading. Other property such as breakwaters, bulkheading, retaining walls, and similar items constructed of perishable materials shall be depreciated.

ACCOUNT 5. TUNNELS AND SUBWAYS

The excavation of tunnels and subways, including backfilling, shall not be depreciated. Concrete and other masonry shall be given a normal life of 100 years.

ACCOUNT 6. BRIDGES, TRESTLES, AND CULVERTS

(*a*) Metal bridges shall be given a normal service life of 70 years, provided that the loads for which they were designed are not now being exceeded.

(*b*) Masonry culverts shall be given a normal service life of 100 years.

(*c*) Cast-iron culvert pipe shall be given a normal service life of 80 years, and other iron or steel pipe a normal service life of 30 years.

(*d*) Vitrified and concrete culvert pipe shall be given a normal service life of 50 years.

(*e*) Masonry piers and abutments shall be given a normal service life of 100 years.

ACCOUNT 7. ELEVATED STRUCTURES

Depreciate on the same basis as Account 6.

ACCOUNT 8. TIES

Where the track has reached such a condition that the tie renewals are uniform in quantity and quality from year to year the service condition shall be considered as 50 per cent. The average life of ties shall be determined by a study of the carrier records of tie renewals supplemented by a consideration of field observations.

ACCOUNT 9. RAILS

Rails shall be considered as having two cycles of life, viz., new to relay and relay to scrap. Each cycle shall be considered separately and have a range of service-condition per cent of 100. The first cycle for a particular carrier shall be determined by a study of its rail renewals and the rail renewals of other carriers in the vicinity having similar traffic conditions. This cycle may vary upon different divisions of the same carrier where traffic conditions are different. A net salvage value shall be allowed for rails at the end of the first cycle equal to the price of relay rail at carrier's nearest material yard, less cost of bringing same from point where renewed.

The second cycle shall be considered as having a normal life of 50 years.

When in depreciating relay rail the date relaid can not be ascertained from records the same shall be estimated from the best available data. Where rail was laid new in sidetracks and will be used in this service until it becomes scrap it shall be given a normal life of 75 years. Where the annual rail renewals in yards have become uniform in quantity and quality a service condition of 50 per cent may be used.

A net price shall be assigned to scrap rail based upon the price of scrap at the carrier's nearest material yard, less cost of bringing same from point where renewed. The weight of relay and scrap rail shall be assumed to be the same as that of new rail.

Account 10. Other Track Material

(*a*) Splice bars shall be depreciated in cycles on the same basis as the rail with which they are used.

(*b*) Bolts shall be depreciated from new to scrap during each cycle of the rail with which they are used.

(*c*) Spikes shall be depreciated on the same basis as the ties with which they are used.

(*d*) Where average annual renewals of frogs and switches are uniform and conditions warrant, they may be depreciated on a 50 per cent basis.

(*e*) All other track material for this account shall be depreciated from new to scrap during each cycle of the rail.

Account 11. Ballast

Ballast shall be depreciated according to the general rules.

Account 12. Track Laying and Surfacing

Track laying and surfacing shall be depreciated with the materials composing the track included under Accounts 8, 9, 10, and 11. The depreciation shall be determined on the basis of the depreciation weighted according to the labor costs assignable to the materials of the several accounts.

Account 13. Right-of-Way Fences

Right-of-way fences shall be depreciated under the general rules.

ACCOUNT 14. SNOW AND SAND FENCES AND SNOWSHEDS

Property under this account shall be depreciated according to the general rules.

ACCOUNT 15. CROSSINGS AND SIGNS

Property under this account shall be depreciated according to the general rules. The normal life of materials stated under Account 6 shall be applied to culverts and bridges.

ACCOUNT 16. STATION AND OFFICE BUILDINGS

Timber structures shall be given a normal service life of 50 years and masonry structures 100 years, suitably modified where observation shows principal parts are new or in need of renewal.

ACCOUNT 17. ROADWAY BUILDINGS

Roadway buildings shall be depreciated as in Account 16.

ACCOUNT 18. WATER STATIONS

ACCOUNT 19. FUEL STATIONS

ACCOUNT 20. SHOPS AND ENGINEHOUSES

ACCOUNT 21. GRAIN ELEVATORS

ACCOUNT 22. STORAGE WAREHOUSES

ACCOUNT 23. WHARVES AND DOCKS

ACCOUNT 24. COAL AND ORE WHARVES

ACCOUNT 25. GAS PRODUCING PLANTS

Property under these accounts shall be depreciated in accordance with the general rules.

ACCOUNT 26. TELEGRAPH AND TELEPHONE LINES

Iron wire shall be given a normal service life of 50 years and copper a normal service life of 100 years. Other property shall be depreciated according to the general rules.

ACCOUNT 27. SIGNALS AND INTERLOCKERS

ACCOUNT 28. POWER DAMS, CANALS, AND PIPE LINES

ACCOUNT 29. POWER-PLANT BUILDINGS

ACCOUNT 30. POWER SUBSTATION BUILDINGS

ACCOUNT 31. POWER-TRANSMISSION SYSTEMS

ACCOUNT 32. POWER-DISTRIBUTION SYSTEMS

ACCOUNT 33. POWER LINE POLES AND FIXTURES

ACCOUNT 34. UNDERGROUND CONDUITS

ACCOUNT 35. MISCELLANEOUS STRUCTURES

ACCOUNT 36. PAVING

ACCOUNT 37. ROADWAY MACHINES

ACCOUNT 38. ROADWAY SMALL TOOLS

ACCOUNT 44. SHOP MACHINERY

ACCOUNT 45. POWER-PLANT MACHINERY

ACCOUNT 46. POWER SUBSTATION APPARATUS

Property coming under these accounts shall be depreciated under the general rules.

ACCOUNT 51. STEAM LOCOMOTIVES

Steam locomotives shall be depreciated according to the general rules.

The percentage finally established as representing the present service condition of each locomotive shall be the weighted average of the assigned condition per cent of the following principal parts:

Engine: (*a*) Boiler; (*b*) underframe; (*c*) running gear.
Tender: (*a*) Trucks; (*b*) underframe; (*c*) tank.

ACCOUNT 52. OTHER LOCOMOTIVES

Use the same rules as set forth under Account 51.

ACCOUNT 53. FREIGHT-TRAIN CARS

Freight-train cars shall be depreciated according to the general rules.

A service condition shall be established for each series of cars, which shall be the weighted average of those cars of the series actually inspected. Not less than 10 per cent of the cars of each series shall be inspected for condition, and a larger percentage where a series contains a small number of cars, or if the cars in a series vary greatly in condition.

The service-condition per cent established for each car inspected shall be the weighted average of the service-condition per cent assigned to the following principal parts of the car: (*a*) Body, (*b*) underframe, and (*c*) trucks.

Account 54. Passenger-Train Cars

Passenger-train cars shall be depreciated according to the general rules.

Each passenger-train car shall be separately inspected to determine service condition, following the same general rules as set forth under Account 53.

Account 55. Motor Equipment of Cars

Account 56. Floating Equipment

Account 57. Work Equipment

Account 58. Miscellaneous Equipment

Property coming under these accounts shall be depreciated in accordance with the general rules.

APPENDIX C

MINE VALUATION

The following extracts are from a letter received by the author from E. H. Batson, Deputy Commissioner of Internal Revenue, under date of July 18, 1921:

In reply to your inquiry of July 15, 1921, regarding methods of mine valuation and application of Hoskold's formulæ, you are advised, no definite rule can be laid down and each property or equity is valued according to the peculiar circumstances in that particular case.

Enclosed please find copy of Form D-Revised (for metals), the various schedules of which are made up to cover all cases and the taxpayer is requested to furnish all information pertinent to his case. From the information thus furnished, the various factors used in the computations of the March 1, 1913 (or other basic date) valuation are obtained.

Also find enclosed copy of Hoskold's Table used by the Metals Valuation Section. You will note that the return of capital in all cases is at 4% compounded annually. The interest rate varies with kind of property and the hazard connected with operation, market, ore reserves, etc., in each particular case. The risk rate varies from 6% as the minimum up to 50% or higher; 6% is considered the lowest hazard commensurate with the safest of mining ventures. Other conditions remaining the same in any property, a lessor would be given the lowest interest or risk rate, the operating owner slightly higher, and the lessee the highest. These differences would be usually from 1% to 6%.

Following is a simple computation for value of the taxpayer's equity in a property as at March 1, 1913. Data to have been obtained from taxpayer's information submitted on Form D.

Property purchased in fee January 27, 1903, for $135,000.00, cash. Property developed and operated since 1905.

Ore reserves March 1, 1913 (This includes developed ore as well as a reasonable amount of probable ore and as would be taken into account by a prospective buyer.)	1,000,000 tons
Estimated operating profit per ton (See Schedule II, Item 9, Form D.)	$2
Total estimated operating profit	$2,000,000
Estimated life based on operating history and conditions as at March 1, 1913	10 years
Risk rate considered commensurate with the hazard of the operation of this particular property	10% and 4%
Factor from Hoskold's table	0.545581
Present worth as at March 1, 1913, of operating profits	$1,091,162
Value of plant and equipment as at March 1, 1913, plus the present worth of necessary capital additions through the life of the property to exhaust the mineral and obtain the estimated operating profit	$200,000
Value of mineral en bloc as at March 1, 1913	$891,162
Unit of depletion per ton of ore sold (depletion being allowed as a tax-free deduction from income on the tons for which income is reported), $891,162 divided by 1,000,000	89.1162 cents

In the case of a Lessor, the royalty per ton received under the terms of the lease is substituted for operating profit and there is no deduction made for plant and equipment but the gross royalties are reduced by the expenses necessary to obtain these royalties.

Cases of operating lessees are handled as the operating owner excepting that operating profit is reduced by the amount of royalty paid, royalty being a proper expense item.

HOSKOLD'S TABLE

The present value of $1 in accumulated earnings of equal annual instalments over a period of years ranging from 1 to 50 inclusive, on the basis of rates of interest varying from 6 to 12 per cent inclusive on the investment, with return of capital at 4 per cent are as follows:

Yrs.	*6%*	*7%*	*8%*	*9%*	*10%*	*11%*	*12%*
1	0.943396	0.934579	0.925925	0.917431	0.909090	0.900910	0.892857
2	0.908766	0.892946	0.876891	0.861777	0.847176	0.833062	0.819408
3	0.876389	0.853937	0.832607	0.812317	0.792993	0.774578	0.756976
4	0.846052	0.818370	0.792418	0.768072	0.745178	0.723608	0.703254
5	0.817570	0.785469	0.755780	0.728260	0.702675	0.678824	0.656540
6	0.790781	0.754961	0.722245	0.692177	0.664641	0.639166	0.615547
7	0.765540	0.726638	0.691435	0.659519	0.630410	0.603769	0.579284
8	0.741717	0.700174	0.663032	0.629635	0.599440	0.572008	0.546979
9	0.719198	0.675487	0.636765	0.602251	0.571286	0.543347	0.518017

Yrs.	*6%*	*7%*	*8%*	*9%*	*10%*	*11%*	*12%*
10	0.697880	0.652354	0.612404	0.577066	0.545581	0.517355	0.491906
11	0.677672	0.630699	0.589748	0.553820	0.522019	0.493671	0.468244
12	0.658489	0.610277	0.568624	0.532281	0.500344	0.472001	0.446702
13	0.640258	0.591066	0.548887	0.512330	0.480337	0.452107	0.427009
14	0.622911	0.572950	0.530401	0.493737	0.461815	0.433770	0.408936
15	0.606385	0.555828	0.513053	0.476390	0.444619	0.416821	0.392292
16	0.590625	0.539630	0.496741	0.460167	0.428610	0.401104	0.376914
17	0.575581	0.524283	0.481376	0.444963	0.413671	0.386493	0.362663
18	0.561205	0.509716	0.466880	0.430685	0.399699	0.372873	0.349420
19	0.547455	0.496371	0.453178	0.417253	0.386603	0.360147	0.337082
20	0.534292	0.482719	0.440211	0.404592	0.374302	0.348230	0.325559
21	0.521680	0.470171	0.427920	0.392637	0.362729		
22	0.509587	0.458216	0.416255	0.381334	0.351818		
23	0.497979	0.446805	0.405166	0.370630	0.341517		
24	0.486835	0.435903	0.394619	0.360479	0.331775		
25	0.476122	0.425477	0.384571	0.350840	0.322549		
26	0.465820	0.415496	0.374988	0.341675	0.313799		
27	0.455905	0.405935	0.365839	0.332951	0.305488		
28	0.446356	0.396767	0.357096	0.324637	0.297587		
29	0.437155	0.387970	0.348734	0.316704	0.290063		
30	0.428283	0.379520	0.340726	0.309127	0.282893		
31	0.419724	0.371399	0.333054				
32	0.411462	0.363589	0.325695				
33	0.403483	0.356072	0.318631				
34	0.395772	0.348832	0.311846				
35	0.388318	0.341856	0.305324				
36	0.381108	0.335128	0.299049				
37	0.374130	0.328637	0.293009				
38	0.367375	0.322371	0.287190				
39	0.360832	0.316318	0.281581				
40	0.354491	0.310468	0.276171				
41	0.348345	0.304811	0.270950				
42	0.342385	0.299339	0.265909				
43	0.336602	0.294043	0.261038				
44	0.330990	0.288913	0.256328				
45	0.325540	0.283945	0.251774				
46	0.320248	0.279128	0.247367				
47	0.315107	0.274459	0.243100				
48	0.310109	0.269929	0.238967				
49	0.305250	0.265533	0.234962				
50	0.300525	0.261266	0.231079				

APPENDIX D

INTERNAL REVENUE BUREAU BULLETIN "F"

Following is bulletin "F" "Depreciation and Obsolescence," issued by the Bureau of Internal Revenue, August 31, 1920.[1]

The contents of this bulletin indicate the trend and tendency of official opinion in the Bureau of Internal Revenue in administering the portions of the Revenue Act of 1918 which provide for the deduction from gross income of reasonable allowances for exhaustion, wear and tear, and obsolescence of property used in trade or business. The subject matter includes Treasury Decisions, Opinions of the Solicitor of Internal Revenue, the Advisory Tax Board and the Committee on Appeals and Review, portions of Regulations 45 and other information of a general nature.

Since obsolescence was not recognized for income-tax purposes prior to the passage of the Revenue Act of 1918, comparatively few rulings have been made on that subject. This bulletin, however, contains several opinions rendered by the Advisory Tax Board relating to intangible assets and other property rendered obsolete by prohibition legislation.

EXCERPTS FROM REVENUE ACT OF 1918

SEC. 214(a). That in computing net income there shall be allowed as deductions: * * *

(8) A reasonable allowance for the exhaustion, wear, and tear of property used in the trade or business, including a reasonable allowance for obsolescence.

SEC. 234(a). That in computing the net income of a corporation subject to the tax imposed by section 230 there shall be allowed as deductions: * * *

(7) A reasonable allowance for the exhaustion, wear, and tear of property used in the trade or business, including a reasonable allowance for obsolescence.

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[1] The contents of Bulletin "F" may be said to represent the general policy of the Bureau of Internal Revenue.

SEC. 215. That in computing net income no deduction shall in any case be allowed in respect of— * * *

(b) Any amount paid out for new buildings or for permanent improvements or betterments made to increase the value of any property or estate;

(c) Any amount expended in restoring property for which an allowance is or has been made; * * *

SEC. 1309. That the Commissioner, with the approval of the Secretary, is hereby authorized to make all needful rules and regulations for the enforcement of the provisions of this Act.

DEFINITIONS

Depreciation means the gradual reduction in the value of property due to physical deterioration, exhaustion, wear, and tear through use in trade or business.

Obsolescence means the gradual reduction in the value of property due to the normal progress of the art in which the property is used, or to the property becoming inadequate to the growing needs of the trade or business. Obsolescence, a gradual lessening of value, must be distinguished from "loss of useful value" (art. 143, Reg. 45), which contemplates an abrupt termination of usefulness.

SCOPE OF DEPRECIATION AND OBSOLESCENCE

DEPRECIATION

An allowance may be deducted by taxpayers for depreciation and obsolescence of certain property either tangible or intangible, which gradually approaches a point where its usefulness in the trade or business is exhausted. The allowance must be confined to property which is actually used in the trade or business. Consequently, it may not apply to a building used by a taxpayer solely as his personal residence, or to furniture or furnishings therein; neither may it apply to his personal effects or clothing, nor to automobiles and other vehicles used chiefly for pleasure.

The allowance does not apply to timber or to bodies of minerals, metals, or other natural deposits which through the process of removal are depleted. Allowance for such depletion is provided in other parts of the Act. See sections 214(a) 10 and 234(a) 9, Revenue Act of 1918. No allowance may be claimed for depreciation of inventories or stock in trade; nor for land apart from the improvements or developments added to it.

No amount may be included in a deduction for depreciation representing reduction in value of property due to change in environment—for example, loss in rental value of property due to deterioration of the neighborhood. Fluctuation in the value of depreciable property has no bearing on net income as shown in income tax returns except to the extent that it is realized upon sale, abandonment, or other disposition of the property.

The potential earning capacity of an individual, his inventive genius or his literary ability may not be made the basis of an allowance for depreciation.

The allowance for amortization of facilities required "after April 6, 1917, for the production of articles contributing to the prosecution of the present war," * * * (sec. 214(a) 9, Revenue Act of 1918), is inclusive of the allowance for depreciation which would ordinarily be allowable separately. Depreciation for any taxable period after December 31, 1917, should, therefore, not be claimed with respect to property as to which an allowance for amortization is claimed for the same taxable period.

Automobiles.—A deduction may be claimed for depreciation of automobiles and similar equipment used in the trade or business. The rate will depend principally on the purpose for which the equipment is used and must be estimated in each case by the taxpayer according to his experience and judgment. A professional man who uses an automobile in making professional calls is entitled to an allowance for depreciation, but if the automobile is used partly for pleasure or purposes apart from the business only a proportionate part of the depreciation sustained may be deducted; if used chiefly for pleasure, no depreciation deduction is allowable.

Bonds and securities.—Bonds and securities are not subject to wear and tear within the meaning of the statute, and therefore the allowance for depreciation does not apply to any shrinkage in their value. The fact that bonds or similar securities are written down in value by direction of the Comptroller of the Currency or a State banking department is immaterial. A deduction for loss with respect to such shrinkage in value will not be allowed except upon maturity of the securities, disposition thereof by sale or otherwise or upon definite ascertainment of their worthlessness. This will not preclude a "dealer in securities" as defined in article 1585 of Regulations 45 from computing the inventory value of the securities which constitute his stock in trade on the basis of "cost or market, whichever is lower" if he has adopted that basis for computing inventories and follows it consistently.

Buildings.—Buildings are recognized as subject to depreciation and in some cases to obsolescence, regardless of their construction or purpose for which used. The deduction is allowable, however, only in the case of buildings owned by the taxpayer and used in trade or business. The rate of depreciation will necessarily depend upon the construction of the building, purpose for which used, climatic conditions, repairs made, etc. A frame building may remain serviceable for a period of 20 to 30 years, while a building of steel, concrete, and stone construction may have a life of 50 to 100 years. The ordinary useful life of factory buildings is further lessened by the vibration incident to the use of heavy high-speed machinery, or by the effect of acids or gases used in certain industries. Similarly constructed buildings will depreciate at varying rates, dependent upon local climatic conditions. The rate to be used in computing the allowance for depreciation will depend in each case upon the conditions affecting the particular property in question.

Depreciation of personal residence.—Depreciation of a building occupied by a taxpayer as his personal residence is not deductible for income tax purposes. If a portion of the residence is used for business purposes, as in the case of a physician or any other professional man who has his office in his home, a proportionate part of the depreciation sustained may be deducted, the amount to be based generally on the ratio of the number of rooms used for business purposes to the total number of rooms in the building. The same principle is applicable if a taxpayer rents a portion of his personal residence to other individuals. Under such conditions, however, the taxpayer must include in his gross income any amounts received as rentals. A taxpayer who is not allowed a deduction for depreciation of his personal residence may, in case he sells the property, disregard depreciation in computing any taxable profit derived from the transaction.

If a taxpayer owns residential property and rents it to other individuals, he is entitled to a deduction for depreciation of the rented property even though the property is not used in his principal trade or business but must include in gross income the entire amount received as rentals.

Alteration of building.—Expenditures by a taxpayer in altering a building to conform to a street widening, which alteration does not increase the value of the building, constitute a business expense for the year in which such expenditures are incurred, deductible only in the return of net income for that year, and any division of such deduction so as to spread the same over the returns for a period of years, whether called a depreciation charge or otherwise, is unauthorized.

Voluntary removal of buildings.—Loss due to the voluntary removal or demolition of old buildings, the scrapping of old machinery, equipment, etc., incident to renewals and replacements may be deducted from gross income in a sum representing the difference between the cost of such property demolished or scrapped and the amount of a reasonable allowance for the depreciation which the property had undergone prior to its demolition or scrapping; that is to say, the deductible loss is only so much of the original cost of the property, less salvage, as would have remained unextinguished had a reasonable allowance been charged off for depreciation during each year prior to its destruction.

Actors' costumes.—If costumes purchased by actors and actresses are used exclusively in the production of a play, and are not adapted for occasional personal use and are not so used, a deduction may be claimed on account of such depreciation in their value as occurs during the year on account of wear and tear arising from their use in the production of the play or on account of their becoming obsolete when the production of the play is discontinued.

Drawings, models, and experimental work.—A taxpayer who has incurred expenses in his business for designs, drawings, patterns, models, or work of an experimental nature intended to result in improvement of his facilities or his product, may at his option deduct such expenses from gross income for the taxable year in which they are incurred or treat such articles and experimental results as capital assets to the extent of the amount so expended. In the latter case, if the period of usefulness of any such asset may be estimated from experience with reasonable accuracy, it may be the subject of depreciation allowances spread over such estimated period of usefulness. Such information as will enable the Commissioner to determine whether the deduction is allowable must be furnished with the return or may be submitted prior to the time of filing the return. Except for such depreciation allowances, no deduction shall be made by the taxpayer against any sum so set up as an asset except on the sale or other disposition of such assets at a loss or on proof of a total loss thereof.

Farm property and equipment: live stock.—A reasonable allowance for depreciation may be claimed on farm buildings (other than a dwelling occupied by the owner), farm machinery and other physical property, including live stock purchased for draft, dairy, or breeding purposes, but no claim for depreciation on live stock raised or purchased for resale will be allowed. Live stock purchased for draft, breeding, or dairy purposes, or for any purpose other than resale, may be included in the inventory for each year at a figure which will reflect the reduction in value estimated to have occurred during the year through increase of age or other causes. Such a reduction in value should be based on the cost and estimated life of the live stock. If an inventory is not used, a reasonable allowance for depreciation may be claimed, based upon the cost of draft and work animals and animals kept solely for breeding purposes and not for resale.

Property acquired by gift, bequest, or devise.—If a taxpayer acquires depreciable property by gift, bequest, or devise, and uses it for purposes of trade or business, he is entitled to a deduction from gross income for depreciation of such property.

Depreciation of intangible property.—Intangibles, the use of which in the trade or business is definitely limited in duration, may be the subject of a depreciation allowance. Examples are patents and copyrights, licenses and franchises. Intangibles, the use of which in the business or trade is not so limited, will not usually be a proper subject of such an allowance. If, however, an intangible asset acquired through capital outlay is known from experience to be of value in the business for only a limited period, the length of which can be estimated from experience with reasonable certainty, such intangible asset may be the subject of a depreciation allowance, provided the facts are fully shown in the return or prior thereto to the satisfaction of the Commissioner. The words "capital outlay" used in this paragraph mean cash, other property, or corporate stock given in exchange for the intangibles.

Depreciation of improvements in the case of mines.—It shall be optional with the taxpayer, subject to the approval of the Commissioner, whether (a) the cost or value of mining property, including ores and minerals, plant and equipment, and charges and additions to capital account not charged to expense and deducted as expense in the returns of the taxpayer, shall be recovered at a rate established by current exhaustion of mineral, or (b) the cost or value of the mineral and charges to capital account of expenditures other than for physical property shall be recovered by appropriate charges based on depletion, and the cost or value of plant and equipment shall be recovered by reasonable charges for depreciation calculated by the usual rules for depreciation or according to the peculiar conditions of the taxpayer's case by a method satisfactory to the Commissioner. This paragraph shall not be interpreted to mean that the value of a mining plant and equipment may be reduced by depreciation or depletion deductions to a sum below the value of the salvage when the property shall have become obsolete or shall have been abandoned for the purpose of mining, or that any part of the value of land for purposes other than mining may be recoverable through depletion or depreciation.

Depreciation of improvements in the case of oil and gas wells.—Both owners and lessees operating oil or gas properties will, in addition to and apart from the deduction allowable for the depletion or return of capital, be permitted to deduct a reasonable allowance for depreciation of physical property, such as machinery, tools, equipment, pipes, etc., so far as not in conflict with the option exercised by the taxpayer under article 223, Regulations 45, of capitalizing the cost of such items or charging it to expense. The amount deductible on this account shall be such an amount based upon its cost or fair market value as of March 1, 1913, equitably distributed over its useful life as will bring such property to its true salvage value when no longer useful for the purpose for which such property was acquired. Accordingly, where it can be shown to the satisfaction of the Commissioner that the reasonable expectation of the economic life of the oil or gas deposit with which the property is connected is shorter than the normal useful life of the physical property, the amount annually deductible for depreciation may for such property be based upon the length of life of the deposit.

Depreciation of improvements in the case of timber.—The cost or value as of March 1, 1913, as the case may be, of development of a timber operation or plant not represented by physical property having an inventory value, and such cost or value of all physical property which has not been deducted and allowed as expense in the returns of the taxpayer, shall be recoverable through depreciation. It shall be optional with the taxpayer, subject to the approval of the Commissioner, whether (a) the cost or value, as the case may be, of the property subject to depreciation shall be recovered at a rate established by current exhaustion of stumpage, or (b) the cost or value shall be recovered by appropriate charges for depreciation computed by the usual rules for depreciation or according to the peculiar conditions of the taxpayer's case by a method satisfactory to the Commissioner. In no case may charges for depreciation be based on a rate which will extinguish the cost or value of the property prior to the termination of its useful life. This paragraph shall not be interpreted to mean that the value of a timber plant and equipment, so far as it is represented by physical property having an inventory value, may be reduced by depreciation deductions to a sum below the value of the salvage when the plant and equipment shall have become obsolete or worn out or shall have been abandoned, or that any part of the value of cut-over land may be recoverable through depreciation.

Leaseholds.—Where a leasehold is acquired for a specified sum, the purchaser may deduct from gross income as a business expense an aliquot part of such sum each year, based on the number of years the lease has to run.

Professional libraries.—A professional man is entitled to deduct a reasonable allowance covering depreciation actually sustained on that part of his library which is necessary and used wholly in the pursuit of his profession, taking as a basis for such allowance, the fair market value as of March 1, 1913, if acquired prior to that date, or the cost, if acquired on or subsequent to that date. The cost of professional periodicals and books purchased by a business or professional man and having a temporary value, should be deducted as an expense of doing business, but the cost of volumes which have a more permanent value to the business or profession, should be capitalized and made the subject of depreciation allowances.

Orchards.—The life of an orchard may be somewhat indefinite, but it can be determined as accurately as the probable life of a building or other tangible property upon which depreciation charges are allowed. In any event it is certain that there is a gradual and ultimate wearing out of an orchard within a number of years after the productive stage has been reached.

All expenditures necessary to bring orchard trees to a producing stage should be capitalized and thereafter a fair and reasonable annual allowance for depreciation may be deducted in order to return to the owner free of taxation the capital invested, just as in the case of an investment in other tangible property used in any other business or trade. The basis for computing the depreciation is the cost of the trees at the time the orchard has reached an income-producing stage, including initial cost and capitalized expenditures incurred in bringing them to maturity, and the rate of depreciation is to be determined by the average life of the trees from the income-producing stage under normal conditions.

In the case of orchards and vineyards acquired subsequent to March 1, 1913, and later destroyed by storms, floods, frost, or otherwise, any deduction for loss should be confined to the amount of capital originally invested in the growing trees and in the new nursery stock which was totally destroyed and the amount expended from date of acquirement to date of destruction in an endeavor to bring such trees and stock to an income-producing state, provided such amount has not been deducted as an expense of doing business. This total must be reduced by the amount of any depreciation sustained. Any expenditures on account of permanent improvements or on account of trees and vines the growth of which was merely retarded and not entirely destroyed may not be included in the deduction for loss.

Organization or promotion expenses.—Organization expenses such as attorneys' and accountants' fees, together with fees paid to State authorities prior to or coincident with the securing of a charter and the incorporation of a business, constitute investments of capital and are not allowable deductions from gross income. Such expenses are not proper items to be added to the cost of any physical property to be provided for through annual allowances for depreciation.

Patents or copyrights.—In computing a depreciation allowance in the case of a patent or copyright, the capital sum to be replaced is the cost (not already deducted as current expense) of the patent or copyright or its fair market value as of March 1, 1913, if acquired prior thereto. The allowance should be computed by an apportionment of the cost of the patent or copyright or of its fair market value as of March 1, 1913, over the life of the patent or copyright since its grant, or since its acquisition by the taxpayer, or since March 1, 1913, as the case may be. If the patent or copyright was acquired from the Government, its cost consists of the various Government fees, cost of drawings, experimental models, attorneys' fees, etc., actually paid. If a corporation purchased a patent and paid for it in stock or securities, its cost is the fair market value of the stock or securities at the time of the purchase. Depreciation of a patent can be taken on the basis of the fair market value as of March 1, 1913, only when affirmative and satisfactory evidence of such value is offered. Such evidence should whenever practicable be submitted with the return. If the patent becomes obsolete prior to its expiration such proportion of the amount on which its depreciation may be based as the number of years of its remaining life bears to the whole number of years intervening between the date when it was acquired and the date when it legally expires may be deducted if permission so to do is specifically secured from the Commissioner. Owing to the difficulty of allocating to a particular year the obsolescence of a patent, such permission will be granted only if affirmative and satisfactory evidence that the obsolescence occurred in the year for which the return is made is submitted to the Commissioner. The fact that depreciation has not been taken in prior years does not entitle the taxpayer to deduct in any taxable year a greater amount for depreciation than would otherwise be allowable.

Assigned patents or copyrights.—In case of patents and copyrights the rights to which have been assigned, the assignor (owner) is entitled to appropriate depreciation deductions as outlined in the preceding paragraph but must report the entire amount of royalties received as income. The assignee may deduct the amount of royalties paid each year, and if he has paid a bonus or lump sum for the patent rights in addition to contracting to pay royalties, he may deduct in addition to the royalties paid an aliquot part of such bonus or lump sum based on the number of years over which his contract or agreement extends.

In an appeal involving depreciation of patents, considered by the Committee on Appeals and Review, the facts and the decision were as follows:

> A invented certain apparatus and secured United States patents thereon. The patents were assigned to a foreign corporation under an agreement by which A retained 40 per cent interest in profits therefrom. Legal title to the patents passed to the company subject to the agreement mentioned. A's interest was recognized by the company and by the United States licensees under the patents. It was held that the agreement should be recognized as giving A a depreciable interest in the patents, and that the value of each patent as at March 1, 1913, should be

segregated and the depreciation allowable thereon determined on the basis of its own life instead of using as a basis the average life of all the patents and the value of all the patents in bulk. Of the total depreciation allowable for any year, 60 per cent is deductible in the return of the company and 40 per cent in A's return.—A. R. M. 35.

OBSOLESCENCE

Prior to the passage of the Revenue Act of 1918, no deduction on account of obsolescence was permitted. It is true that articles 177, 178, and 179 of Regulations No. 33, revised, promulgated in connection with the Revenue Act of 1917, authorize deductions for obsolescence, but the term as there used refers not to the *gradual* reduction in value due to the normal progress of the art but rather to the amount of loss sustained when the property *has become obsolete.* It contemplates a completed rather than a continuing process. Its parallel is to be found in article 143 of Regulations 45—Loss of Useful Value.

Obsolescence of buildings.—No amount may be charged off in any year in anticipation of obsolescence of a building which *may* become obsolete a number of years later. A certain amount of obsolescence may, however, be claimed from the time it becomes certain that at a definite future date the building will be obsolete. The figure representing obsolescence shall be approximately the difference between the fair market value of the building as at March 1, 1913, or its cost if acquired on or after that date, less depreciation, and the estimated salvage value. This obsolescence should be spread over the period from the time such obsolescence becomes certain until the building becomes obsolete, and should be claimed in the returns filed for those years. For instance the fair market value of a building March 1, 1913, was $30,000. Its depreciated value December 31, 1918, was $18,000, and its estimated salvage value in 1920 will be $5,000. At the end of the year 1918, it was definitely determined and certain that in 1920 the building would have to be torn down and replaced by a larger building, due to its inadequacy to meet the growing demands of the industry which it housed. The difference between the depreciated value December 31, 1918 ($18,000), and its estimated salvage value ($5,000) represents ordinary depreciation plus obsolescence. This amount of $13,000 should be spread over the years 1919 and 1920, and deduction claimed accordingly in returns filed for those years. In cases where obsolescence is claimed, it must be supported by a statement sufficient to establish the facts upon which it is based.

Obsolescence of intangibles.—Obsolescence is not ordinarily applicable in the case of intangibles but will be allowed in exceptional cases, as in the case of the discontinuance of a going business because of the exhaustion of its source of supply, where the cost of the good will, or its value as of March 1, 1913, if acquired prior to that date, can be definitely shown and the period of its obsolescence determined with reasonable accuracy.

To sustain a claim for deduction for obsolescence of good will, it must be shown that the good will will be of no value at the close of an approximately definite period, and that the taxpayer will be forced to discontinue the business and be unable to continue in another similar business.

An allowance for obsolescence of good will will be made only in connection with such good will as is assignable, as distinguished from good will attaching to individuals owning or conducting a business or to the premises at which it is or was conducted; and no allowance for obsolescence will be granted in any case where, in connection with the operation of the business, the good will will be valuable in another business after the termination of the business in which the taxpayer is engaged.

Ore-sampling business.—A taxpayer engaged in the business of sampling ores is entitled to a deduction for obsolescence not only of his plant and equipment but for value of good will existing and having a definitely established value as of March 1, 1913, or acquired thereafter by capital outlay, if it can be shown that the plant and equipment will be useless and the good will of no value at the close of an approximately definite period by reason of exhaustion of the ores on which the business depends.

Bottle manufacturing plants.—Property consisting of a plant, including equipment, for the manufacture of beer bottles, which because of prohibition legislation has lost its usefulness and can not be sold has, to the extent the property or plant was constructed for the manufacture of beer bottles and is not suited or adapted for any other purposes without reconstruction, become obsolete, and the taxpayer to that extent is entitled to a deduction for obsolescence. That part of the shrinkage in value of the plant, if any, which is not thus due to obsolescence may not be claimed as a deduction for loss until the property is sold or becomes worthless and the loss is definitely ascertained.

Property of brewers and distillers.—The same principle stated in the case of bottle manufacturing plants is applicable in the case of other property or equipment of distillers, brewers, and liquor dealers which has been impaired in value through prohibition legislation. The loss in value may be established by evidence other than the actual sale of the obsolete property.

Intangible assets of brewers, distillers, and dealers in liquor.—In Advisory Tax Board Memorandum 44 (Cumulative Bulletin, December, 1919, p. 133) it was held that distillers and dealers in liquor are entitled to make a deduction (based upon actual cost or fair market value as at March 1, 1913) from gross income, on account of depreciation or obsolescence of their intangibles, such as good will, trademarks, trade brands, etc., such deduction being limited to assignable assets, the value of which has been destroyed by prohibition legislation, and that in arriving at the taxable income for the first taxable year ending on or after January 31, 1918, the obsolescence fully accrued on that date is to be allowed as a deduction in computing the income subject to taxation under the Revenue Act of 1918, plus a further deduction of such proportion of the remaining value of the intangible assets as the interval between January 31, 1918, and the end of the taxable year bears to the total interval between January 31, 1918, and January 16, 1920 (unless at an earlier date the taxpayer discontinues his business, in which case such earlier date shall mark the close of the period), and that for any taxable year following the taxable year just referred to a deduction in respect of the value of such intangible assets on January 31, 1918, based upon a ratable distribution, will be permissible. This paragraph applies also to brewers.

Vineyards.—The question as to whether a deduction is allowable under the Revenue Act of 1918 for obsolescence in the case of vineyards the usefulness of which is impaired or destroyed in whole or in part by prohibition legislation was considered by the Solicitor of Internal Revenue and an opinion rendered as follows:

> It is represented that certain vineyards are seriously affected by prohibition legislation; that by reason of the character of the grapes which they produce the owners have been unable up to the present time to find a market to replace that which prohibition laws are about to destroy; that while in some instances there

may still be an opportunity to use, for wine-making purposes, the crop of the year 1919, in many cases the opportunity for making wine is already passed; that experiments are now being conducted in the hope of finding a way to utilize the particular variety of grapes here considered so that it will not be necessary to abandon the vineyards; and that in view of such experiments the vineyards in question have, in many instances, not been junked, but are being cultivated in the hope of finding a profitable use for the crop. It is further represented that in some cases these vineyards will be or already have been abandoned, the vines pulled up, and the land planted to other crops, and that in a few instances owing to the character of the land or its location, the total abandonment of the vineyards for any purpose may result.

While the Act of October 3, 1913, and the Revenue Act of 1917 were construed to allow a deduction for obsoleteness, demonstrated by the actual junking or abandonment of property, as a deduction in determining the net income of an individual or a corporation, obsolescence, or the gradual becoming out of use, was not recognized as an allowable deduction prior to the Revenue Act of 1918.

Obsolescence—that is, the process of gradually becoming out of use—has long been recognized in the manufacturing world as a material factor in determining the useful life of machinery. It has been a matter of general experience that whereas the physical life of a machine when wear and tear only were considered might be 20 years, yet its useful life in a given employment might be materially shortened by the introduction of improved processes and new inventions, and that where the new processes and inventions were revolutionary its useful life might be reduced to a brief period, the minimum being the time necessary for the manufacture and installation of the new machinery.

The effect of prohibition legislation upon wine vineyards is so closely analogous to that produced by the introduction of revolutionary inventions in manufacturing as to bring it clearly within both the reason and the language of the statute. A reasonable deduction for the obsolescence thus resulting is, therefore, allowable.

Where a vineyard planted to wine grapes continues to be cultivated after the enactment of prohibition legislation in the hope that some new and profitable use for the crop may be found, it now appears that a material loss will be incurred by the owner. The situation, however, is so novel as to render the determination of the amount of the loss impossible at this time, and there is no data available from which to determine the length of time that will be required to ascertain whether such use for the grapes may be found. These elements of uncertainty must be recognized in making any ruling as to the deductions allowable in the case cited and necessitate a departure from the rule heretofore followed that what constitutes a proper deduction is to be determined by the facts existing at the time the loss is incurred and that neither the taxpayer nor the Government can be allowed to amend the return to accord with subsequently ascertained facts. A "reasonable allowance" in advance of actual obsoleteness can only be made by allowing a tentative deduction for obsolescence for the tax year in which the legislation is passed, leaving the definite determination of the loss involved to await the result of the experiment. The deduction allowed by the statute is a "reasonable allowance" which involves a recognition that it must be made on a basis less certain than is required where an actual loss based on previous abandonment is claimed. From a memorandum of the Advisory Tax Board it is learned that the Board considers that where abandonment has not occurred and the vineyards are being experimentally cultivated one-half the loss which would result in case of failure to find a profitable use for the grapes produced by the vineyard will be a reasonable tentative deduction upon an obsolescence basis for the tax year in which the prohibition act is passed, it being assumed that two years will be a sufficient period within which to determine the success or failure of the experiment, and this conclusion is regarded as reasonable. Should obsoleteness not ensue within the second year, this allowance will prove to have been too liberal.

Where a vineyard is abandoned for the growing of wine grapes and the vines and improvements incidental solely to such use are junked and the land applied to other uses, there is a definite basis for the determination of the loss. Such loss is represented by the difference between the value of such vines and improvements on March 1, 1913, if previously acquired, or their cost if subsequently acquired, and their salvage or junk value plus any depreciation previously charged off. This loss by obsolescence will be distributed over the period elapsing between the time when the prohibition measure causing it was passed and the year in which abandonment occurs. Any improvements, such as the installation of drainage or irrigation, fencing, breaking up of the ground, or similar improvements, which, although incidental to the planting of the vineyard, tend to permanently improve the land for other uses, are not to be included in determining the value or cost of the property abandoned.

Generally speaking, no allowance for obsolescence or obsoleteness is allowable in the case of land, because deductions for these causes depend upon substantial loss of use, and the presumption is that land which has been useful for one purpose will still be of use for some other purpose. In rare instances, however, this presumption may be overcome by the production of evidence tending to show that after the prohibitory law becomes effective the land will not be commercially profitable for any purpose. Mere decrease in the value of land, of even 40 or 50 per cent, will not be sufficient basis for an allowance for obsolescence or for obsoleteness. Such decrease in value can be deducted only when realized by sale or in some other manner. The exception here made is in the case of land which not only decreases in value but decreases to so marked a degree that it becomes practically worthless. This decrease must be due to a substantial loss of usefulness of the land through the prohibition legislation, due to the fact that the vineyard land is not susceptible of profitable cultivation in other crops because of the character of the soil or its location. Where the taxpayer has successfully shown that his case is one of the unusual cases in which the land is rendered substantially useless by prohibition legislation, a deduction for obsolescence of the land as well as the vines and improvements is allowable, and in such case it will be proper to include in the cost or value used as the basis of obsolescence the value of any improvements which were regarded as increasing the permanent value of the property and which have not heretofore been treated as an expense.

It is therefore held that:

(1) Where vineyards planted to wine grapes appear to be rendered useless for profitable operation as vineyards through the enactment of prohibition legislation, but the owners continue to cultivate them in the hope that some new and profitable use for the crop may be found, a reasonable deduction for obsolescence may be claimed. There being at this time no data available upon which a determination of what constitutes a reasonable deduction may be made, a tentative deduction of one-half the loss which would result from the total abandonment of the property for vineyard purposes may be made in the return for the year in which the legislation was enacted, subject to adjustment when the success or failure of the experiment shall have been satisfactorily established.

(2) Where vineyards devoted to the growing of wine grapes are, as a result of prohibition legislation, abandoned as vineyards and the vines and improvements incidental solely to grape growing are junked and the land employed in other uses, the loss directly resulting may be deducted in determining the net income of the owner, care being taken to exclude from the deduction the value of any improvements, such as installation of drainage or irrigation, fencing, breaking up of the soil, and similar improvements, which while incidental to the planting of the vineyard, tend to permanently improve the ground for other uses. The allowance for obsolescence will be distributed over the period elapsing between the passage of the prohibition measure and the date when abandonment occurs.

(3) In general, no deduction for obsolescence or obsoleteness is allowable in the case of land, but in exceptional cases, where the loss of usefulness through prohibition legislation is so great that the land practically becomes worthless, the taxpayer may, upon the proper showing, be allowed a reasonable deduction on that account for the land as well as for the vines and improvements. In this case the cost or value used as the basis of such deduction for obsolescence or obsoleteness may properly include the value of any improvements which when made were regarded as permanently improving the land and which have not heretofore been charged off as expenses. In the case where the entire deduction is claimed in a single year by reason of actual abandonment on account of obsoleteness of land, vines, and improvements, the amount of such deduction will be the difference between the value on March 1, 1913, if acquired prior to that date, or the cost, if acquired on or after that date, and the salvage or junk value, taking into account any deductions or obsolescence previously allowed. Where a reasonable allowance for obsolescence is claimed before actual abandonment, to be spread over a period of two or more years, care must be taken to eliminate from the sum used as the basis of the allowance any general decrease in the value of real estate due to other causes, such decrease being deductible only when definitely determined through sale.

(4) Any return of income from vineyard property in which a

deduction is claimed as a result of obsolescence must be accompanied with an affidavit setting forth fully the facts necessary to a determination of the loss properly chargeable to obsolescence under the rules above stated.

(5) Law Opinion 524 and Solicitor's Memoranda 735, 797, and 872 are modified so far as not in accord herewith.—O. 862.

Basis for Computation of Deduction

The basis for computing the amount deductible on account of depreciation and obsolescence is the cost of the property, or its fair market value as of March 1, 1913, if acquired by the taxpayer prior to that date, and the probable useful life of the property in the trade or business. The fair market price or value of property as of March 1, 1913, is considered to be the cost of the property less depreciation sustained to that date unless the taxpayer can establish a greater value by evidence satisfactory to the Commissioner. To the cost or the fair market value as of March 1, 1913, should be added from time to time the cost of improvements, additions, or betterments not deducted as expenses in the taxpayer's returns, and from it should be deducted the amount of any damage to the property or loss of property through casualty.

In case of property acquired by gift, bequest, or devise, the deduction is based on the fair market price or value of the property at the date when acquired, or if acquired prior to March 1, 1913, its fair market price or value as of that date, and its remaining useful life in the trade or business, proper adjustment being made from time to time by reason of improvements, additions, betterments, or losses since acquirement or since March 1, 1913.

Prior to the approval of Treasury Decision 2754 (August 23, 1918) depreciation allowances were required to be based on the cost of the property. This Treasury decision authorized depreciation deductions based on the value of property as of March 1, 1913, if acquired prior thereto. The basis in the case of property acquired on or after that date remained unchanged.

In an opinion rendered by the Solicitor of Internal Revenue it was held that Treasury Decision 2754 is applicable to returns for 1913 and all subsequent years. This Treasury decision was based on a prior opinion of the Solicitor of Internal Revenue in which it was held that the depreciation charges allowable for any year represent the portion of the gross income of the year necessary to make good a capital shrinkage, that the charges should therefore be such as to amount in the aggregate during the life of the depreciating property to the value of that property as a capital asset; and that under the United States Supreme Court decisions in *Doyle* v. *Mitchell Brothers Co.,* 247 U. S. 179, and *Lynch* v. *Turrish,* 247 U. S. 221, this capital value should be determined as of March 1, 1913.

In no case, however, may the total amount to be returned to the taxpayer through depreciation deductions exceed the cost of the property in question or its value as of March 1, 1913, if acquired prior to that date. When the fair market price or value of property as of March 1, 1913, is used as the basis for computing depreciation deductions, such price or value should be spread ratably over the remaining useful life of the property and deductions made accordingly. Such deductions are allowable until the total equals the fair market price or value of the property as at March 1, 1913, irrespective of amounts deducted prior to that date. For example, A erects an office building in 1908 at a cost of $540,000, its estimated useful life being 50 years. The annual charge for depreciation would be $10,800. The fair market value of the building March 1, 1913, substantiated by proper evidence is $540,000. This amount may be spread ratably over the remaining useful life of the property, 45 years, and $12,000 charged off each year until the full amount of $540,000 has been charged off irrespective of the fact that over $50,000 will have been charged off prior to 1913.

The appreciation in the value of the building as of March 1, 1913, over the cost less depreciation sustained to that date should be evidenced by proper book entries in order that the aggregate of the depreciation charged off will not exceed the debits to the building account. The amount of appreciation thus set up on the books is not required to be returned as income since appreciation in the value of property is not considered income prior to its realization through conversion of the property.

Allowances for depreciation may under no circumstances be based on a fictitious cost price or value of property, or on its replacement value. If property was acquired prior to March 1, 1913, and its fair market value as of that date forms the basis for computing the allowance for depreciation and obsolescence, such value must be substantiated by evidence satisfactory to the Commissioner. No appraised value as of any date other than March 1, 1913, may be used as the basis for computing the allowance.

What the fair market price or value of property was on March 1, 1913, is a question of fact to be established by any evidence which will reasonably or adequately make it appear.

The meaning of the term "fair market value" for income tax purposes is outlined in the following paragraphs from Advisory Tax Board Recommendation 57:

> Section 202 (b) of the Revenue Act of 1918, provides: "When property is exchanged for other property the property received in exchange shall, for the purpose of determining gain or loss, be treated as the equivalent of cash to the amount of its *fair market value, if any;* * * *."
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> By the use of the language quoted Congress recognized that for the purpose of determining gain or loss derived from the exchange of property for property, property received in exchange may not have any "fair market value," the object of the present inquiry is to secure a statement in general terms of the circumstances under which, for this purpose, property received in exchange may be said to have no "fair market value."
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> In the absence of reason to the contrary the words, "fair market value" must be given their ordinary meaning. The expression "market value" either with or without the adjective "fair," is a familiar one and has frequently been defined and explained. Without attempting in this recommendation to collate these definitions, it may be said that they amount in substance to this, that the "market value" of property is the fair value of the property in money as between one who wishes to purchase and one who wishes to sell. It is not, however, what can be obtained for the property when the owner is under peculiar compulsion to sell or the purchaser to buy; nor is it a purely speculative value which an owner could not reasonably expect to obtain for the property although he might possibly be fortunate enough to do so. "Market value" is the price at which a seller willing to sell at a fair price and a buyer willing to buy at a fair price, both having reasonable knowledge of the facts, will trade. It implies the existence of a public of possible buyers at a fair price. The adjective "fair" emphasizes the idea of fairness inherent in this conception of market value, and excludes any possibility of a construction of the words "market value" with reference to a market in which, or to circumstances of sale under which, for any reason a fair price could not be obtained. Under this interpretation property received in exchange for other property has no "fair market value" for the purpose of determining gain or loss resulting from such exchange when, owing to the condition of the market, there can be no reasonable expectation that the owner of the property, though wishing to sell, and any person wishing to buy will agree upon a price at which to trade unless one or the other is under some peculiar compulsion; that is, property has no "fair market value" when market conditions are such that there would be no trading in the property in question at a fair price. It does not follow, however, that property has no "fair market value" merely because there is no price therefor established by public sales or sales in the way of ordinary business. The fact that there is no "market price" or "current

price" so established does not indicate that the property may not readily be sold at a fair price, and the meaning of "market value" is not ordinarily so restricted. The courts have recognized not only that there are cases in which property has no "market value," or more properly "market price," in this restricted sense, but also that there are cases in which property has no "market value" in the broader sense in which the words are used in the statute as herein construed. See *Wall* v. *Platt*, 169 Mass. 398; *Montgomery County* v. *Schuykill Bridge Co.*, 110 Pa. St. 54.

A construction of the statute in which the words "fair market value" are defined as above indicated is in accord with its theory and purpose. A fundamental consideration in income taxation is to determine when income, or elements essential to the computation of income, such as gain and loss, are realized. Clearly, gain or loss is realized upon the sale of property for cash. It seems, moreover, that even apart from express statutory provision gain or loss is realized from the exchange of property for other property which may fairly be said to be the equivalent of cash. See *California Copper Syndicate* v. *Harris*, 41 Scot. L. R. 691; 5 Tax Cas. 159. Such was the ruling of the Bureau under the Act of October 3, 1913, and the Revenue Act of 1916. (O. 434.) The Revenue Act of 1918 expressly recognizes this principle in the language now under consideration in providing that "the property received in exchange shall * * * be treated as the equivalent of cash." It is reasonable to regard property which has a "fair market value," as the words are herein defined, as "the equivalent of cash." A taxpayer receiving such property can determine the amount of his gain or loss in terms of cash with a reasonable degree of certainty and can, if necessary, without undue sacrifice, obtain by the sale of such property cash with which to pay his taxes. It is, however, unreasonable to regard property which has no "fair market value," in this sense, as "the equivalent of cash." A taxpayer receiving such property can neither determine the amount of his gain or loss with certainty nor obtain cash by sale of the property without sacrifice.

It may be argued against the construction here given to the words "fair market value" that these words are used in other parts of the statute in such a way as to imply that property always has a "fair market value" and that the same meaning should be given to the words throughout the statute. Thus, in ascertaining gain or loss upon the sale or other disposition of property acquired before March 1, 1913, the basis is "the fair market price or value of such property as of that date" (sec. 202(a) 1), or, where stock or securities acquired before March 1, 1913, are exchanged for other stock or securities in connection with a reorganization, merger, or consolidation, "the fair market value as of that date" (sec. 202(b)). So in ascertaining the amount of depletion in the case of property acquired before March 1, 1913, the basis is the "fair market value * * * on that date," and in the case of property having a discovery value the basis is the "fair market value of the property at the date of the discovery, or within 30 days thereafter." (Secs. 214(a) 10; 234(a) 9.)

The provisions above quoted raise no necessary implication that property always has a "fair market value." The resort to "fair market value" in the case of discovery can be made only where the "fair market value of property is materially disproportionate to the cost"; that is, it must appear that the property has a "fair market value" and that such value is materially disproportionate to cost. There is no presumption that either fact exists. In the case of depletion of property acquired before March 1, 1913, "fair market value" is to "be taken in lieu of cost up to that date." The natural construction of this language is that "fair market value" is to be taken wherever possible, otherwise "cost up to that date." In ascertaining the gain or loss resulting from the sale or other disposition of property the purpose of valuing such property on March 1, 1913, is to determine the amount which must be withdrawn from the sale price in order to keep the capital intact. In the case of a sale or other disposition of property, not, however, including depletion (see *Stanton* v. *Baltic Mining Co.*, 240 U. S. 103), it would be necessary to so withdraw the value of the property on March 1, 1913, even if there was no statutory provision therefor. See *Doyle* v. *Mitchell Bros.*, 247 U. S. 179; *Lynch* v. *Turrish*, 247 U. S. 221; *Southern Pacific Co.* v. *Lowe*, 247 U. S. 330. The present statute must be construed as authorizing the withdrawal of such value. This result can be reached either by holding that all property had a "fair market price or value" on March 1, 1913, or by holding that "fair market price or value" is the statutory measure of the value to be withdrawn in any case in which the property has a "fair market price or value," but that where it has no such "fair market price or value" other means of measuring value must be resorted to. The latter interpretation gives to the words "fair market * * * value" their ordinary meaning, and, while recognizing that they have the same meaning throughout the statute, gives effect to the words "if any" in the paragraph under consideration. It seems, therefore, the more reasonable.

Since "fair market price," if not synonymous with "fair market value," is narrower in its scope, it seems unnecessary to distinguish between the expression "fair market price or value" and "fair market value." While it is possible to construe the words "fair market" as modifying only the word "price" and not the word "value" in section 202(a), the use of the phrase "fair market value" in other parts of the statute seems to indicate that this is not the proper construction. It may be noted, however, that if this construction were adopted the same result would be reached as is reached on the lines developed in this recommendation.

Some practical bearings of the construction herein given to the statute should be noted. Statements herein made are, however, far from exhaustive of a subject of special difficulty in the application of a general principle to specific cases. In determining whether property has a "fair market value" all available evidence must be considered. A case in which property has no "fair market value" should be regarded as unusual, and a determination that property has no "fair market value" should not be made lightly. Property is not without "fair market value" merely because there is a considerable divergence of opinion as to its value. "Fair market value" is to a large extent a matter of opinion and men of equally wise judgment will differ widely

> in their opinions. Frequently excellent evidence as to the "fair market value" of property, especially that which, though not ordinarily traded in, has a value in use, is found in its cost, or in the cost of reproducing it, with adjustments for depreciation and the like. (It should be noted, however, that while cost is frequently excellent evidence of "fair market value," "fair market value" may be either greater or less than cost and must, wherever made the statutory test, be taken regardless of its relation to cost.) As already pointed out, property can not be said to have no "fair market value" merely because no price therefor is established by public sales or sales in the way of ordinary business. Of course it is not essential that property be listed or traded in on any exchange in order that it may have a "fair market value." For example, stock in a small closely held corporation does not *ipso facto* lack "fair market value," nor does article 1563 of Regulations 45 so hold. Evidence as to the assets and liabilities of such a corporation and as to its earnings may furnish very definite indications as to its "fair market value." Even if a corporation is newly organized and has never done business as such, but has succeeded to the business of an individual or partnership, its stock will ordinarily have a "fair market value" ascertainable by reference to its assets and liabilities, the history of the specific business, and the history and conditions of the industry in general. Similar considerations apply to other kinds of property.
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> In any case in which it is found that property received in exchange has no "fair market value" and that, consequently, no gain or loss results from the exchange, the property received in exchange is to be treated as taking the place of the property exchanged therefor and takes as its value for the purpose of computing depreciation, depletion and gain or loss resulting from sale or other disposition, the cost, or the market value on March 1, 1913, or on the date of discovery, as the case may be, of the property exchanged for it. Property which has no "fair market value" for the purpose of determining gain or loss under section 202(b) has no "fair market value" for any of the purposes of the Revenue Act of 1918.
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> It is held, therefore, that section 202(b) of the Revenue Act of 1918 must be construed as recognizing that there are exchanges of property for other property which do not result in taxable gain or deductible loss for the reason that the property received in exchange has no "fair market value." A general statement as to the circumstances under which this is true is made in the body of this recommendation.—T. B. R. 57.

The Committee on Appeals and Review considered the subject of valuation of intangible assets as of March 1, 1913, and reported as follows:

> The Committee has considered the question of providing some practical formula for determining value as of March 1, 1913, or of any other date, which might be considered as applying to intangible assets, but finds itself unable to lay down any specific rule of guidance for determining the value of intangibles which

would be applicable in all cases and under all circumstances. Where there is no established market to serve as a guide the question of value, even of tangible assets, is one largely of judgment and opinion, and the same thing is even more true of intangible assets such as good will, trade-marks, trade brands, etc. However, there are several methods of reaching a conclusion as to the value of intangibles which the Committee suggests may be utilized broadly in passing upon questions of valuation, not to be regarded as controlling, however, if better evidence is presented in any specific case.

Where deduction is claimed for obsolescence or loss of good will or trade-marks, the burden of proof is primarily upon the taxpayer to show the value of such good will or trade-marks on March 1, 1913. Of course, if good will or trade-marks have been acquired for cash or other valuable considerations subsequent to March 1, 1913, the measure of loss will be determined by the amount of cash or value of other considerations paid therefor, and no deduction will be allowed for the value of good will or trade-marks built up by the taxpayer since March 1, 1913. The following suggestions are made, therefore, merely as suggestions for checks upon the soundness and validity of the taxpayers' claims. No obsolescence or loss with respect to good will should be allowed except in case of actual disposition of the asset or abandonment of the business.

In the first place, it is recognized that in numerous instances it has been the practice of distillers and wholesale liquor dealers to put out under well-known and popular brands only so much goods as could be marketed without affecting the established market price therefor and to sell other goods of the same identical manufacture, age, and character under other brands, or under no brand at all, at figures very much below those which the well-known brands commanded. In such cases the difference between the price at which liquor was sold under a given brand name and also under another brand name, or under no brand, multiplied by the number of units sold during a given year gives an accurate determination of the amount of profit attributable to that brand during that year, and where this practice is continued for a long enough period to show that this amount was fairly constant and regular and might be expected to yield annually that average profit, by capitalizing this earning at the rate, say, of 20 per cent, the value of the brand is fairly well established.

Another method is to compare the volume of business done under the trade-mark or brand under consideration and profits made, or by the business whose good will is under consideration, with the similar volume of business and profit made in other cases where good will or trade-marks have been actually sold for cash, recognizing as the value of the first the same proportion of the selling price of the second, as the profits of the first attributable to brands or good will, is of the similar profits of the second.

The third method and possibly the one which will most frequently have to be applied as a check in the absence of data necessary for the application of the preceding ones, is to allow out of average earnings over a period of years prior to March 1,

> 1913, preferably not less than five years, a return of 10 per cent upon the average tangible assets for the period. The surplus earnings will then be the average amount available for return upon the value of the intangible assets, and it is the opinion of the Committee that this return should be capitalized upon the basis of not more than five years's purchase—that is to say, five times the amount available as return from intangibles should be the value of the intangibles.
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> In view of the hazards of the business the changes in popular tastes and the difficulties in preventing imitation or counterfeiting of popular brands affecting the sales of the genuine goods, the Committee is of the opinion that the figure given of 20 per cent return on intangibles is not unreasonable, and it recommends that no higher figure than that be attached in any case to intangibles without a very clear and adequate showing that the value of the intangibles was in fact greater than would be reached by applying this formula.
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> The foregoing is intended to apply particularly to businesses put out of existence by the prohibition law, but will be equally applicable so far as the third formula is concerned, to other businesses of a more or less hazardous nature. In the case, however, of valuation of good will of a business which consists of the manufacture or sale of standard articles of every-day necessity not subject to violent fluctuations and where the hazard is not so great, the Committee is of the opinion that the figure for determination of the return on tangible assets might be reduced from 10 to 8 or 9 per cent, and that the percentage for capitalization of the return upon intangibles might be reduced from 20 to 15 per cent.
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> In any or all of the cases the effort should be to determine what net earnings a purchaser of a business on March 1, 1913, might reasonably have expected to receive from it, and therefore a representative period should be used for averaging actual earnings, eliminating any year in which there were extraordinary factors affecting earnings either way. Also, in the case of the sale of good will of a going business the percentage rate of capitalization of earnings applicable to good will shown by the amount actually paid for the business should be used as a check against the determination of good will value as of March 1, 1913, and if the good will is sold upon the basis of capitalization of earnings less than the figures above indicated as the ones ordinarily to be adopted, the same percentage should be used in figuring value as of March 1, 1913.—A. R. M. 34.

The Advisory Tax Board in Memorandum 39 considered the application of a taxpayer for authority to compute depreciation and obsolescence of an intangible asset (a patented invention) for 1918 on the basis of value as of the beginning and the end of that year, instead of basing the deduction on cost. The facts and the decision follow:

> The claim of the taxpayer is that depreciation and obsolescence should be allowed to the full amount of the 1918 income; that in

arriving at the amount of depreciation and obsolescence the value of the intangible property as of January 1, 1918, and the value as of December 31, 1918, should be taken as the two determining factors.

This claim must be denied. The purpose of all deductions, whether by way of depreciation, obsolescence, depletion, or loss, is to allow a return to the taxpayer of his capital investment without subjecting such capital to income tax. In determining the amount of capital to be recovered without taxation, considerations of practicability must govern. It must, for instance, be capable of measurement by such instruments as are available in the administration of a tax law. This does not mean that other forms of capital do not exist, but merely that a point is reached at which it becomes administratively impracticable to distinguish between capital and income. In such cases the major portion of the annual realization is normally income; therefore the presumption must be adopted that the whole amount is income. Applying this principle to the present case, it will be seen that A through a series of years had by study, training, experimentation, and other means developed a capacity for producing technical devices of a high order. To a considerable extent, however, the expenditures necessary to reach this attainment are of a kind common to all men and are necessary to fit any man to earn a living. Nor is it possible to differentiate between the man of genius and the ordinary man in such a way as to impute a capital investment to the one when it must as a practical matter be denied to the other, for, of course, genius is attributable to gifts of nature more than it is to outlays upon educational or other development.

Even though it were practicable by finer instruments of measurement to reach a capital value of the individual's developed capacity, it would not meet the claim now under consideration, which is, as stated above, that the capital value subject to depreciation and obsolescence as from January 1, 1918, is the market value of the particular device. Such market value on that date would be equal to the discounted value of the anticipated earnings, or, in other words, the capital sum would consist of the income which it is the design of the income tax law to tax. This principle, if applied to property generally, as it would have to be if allowable in the case now under consideration, would not only cripple the present tax law, but in large measure would make all income immune from taxation. The rule that cost in the case of property acquired since March 1, 1913 (except as to gifts and inheritances which are specifically otherwise provided for in the law) [is the only element of value which can be recognized as capital], rests securely on the ground that capital created by human effort must pass through the door of taxable income before it can for the purpose of that tax establish its position as capital. The law does not tax value appreciation, nor does it recognize value appreciation as capital until such appreciation has been realized and taxed. Neither does the law lay a tax upon the creation of ideas or devices, nor can it without devitalizing itself recognize as capital the value of such mental or material conceptions until after such value has been realized by sale or in such other manner as will first give it the status of taxable income. This step having been taken, the value to the new owner upon which he may claim a capital allowance in computing net income is the cost to him. This is a fundamental in the basis of income taxation, and no exception thereto can be allowed except such as are specifically provided for by the statute.

Stress was laid by the taxpayer upon the provisions of section 214(a) 10 and of section 234(a) 9, which provide that in the case of mines, oil and gas wells, discovered by the taxpayer, the value under certain conditions may be taken as the fair market value of the property at the date of discovery or within 30 days thereafter. This, however, is not a normal rule for the computation of net income, but is an exception specifically granted by the statute and carefully restricted to mines and oil and gas wells. That other kinds of property or other taxpayers may be equally meritorious is immaterial; they are omitted by the statute and can not be brought within it by any proper method of construction.

For the reasons above indicated the Advisory Tax Board recommends that the claim of the taxpayer for a deduction from gross income by way of depreciation and obsolescence based upon the value of his intangible property at January 1, 1918, be denied, and that the amount of each deduction be limited to a reasonable amount based upon the specific cost to him of such property exclusive of all items of such cost which have been deducted as expenses in income tax returns for previous years.—T. B. M. 39.

RATE OF DEPRECIATION—PROBABLE USEFUL LIFE OF PROPERTY

Consideration of the elements entering into depreciation and of the many problems arising therefrom, involves questions of great difficulty, the solution of which does not yield to exact determination in such a manner that precise rules of treatment can be established or theoretical formulæ deduced which can be applied to all cases, or even to many. It is considered impracticable to prescribe fixed, definite rates of depreciation which would be allowable for all property of a given class or character. The rate at which property depreciates necessarily depends upon its character, locality, purpose for which used, and the conditions under which it is used. Manufacturing plants in the same locality, doing identically the same kind of business, depreciate at widely different rates, to a large extent dependent upon the management and the fidelity with which repairs are made and the property maintained; but so many other elements enter into the question that even the relative importance of the different factors can be determined only with difficulty and as approximations. The taxpayer should in all cases determine as accurately as possible according to his judgment and experience the rate at which his property depreciates. The rate used will, however, be subject to the approval of the Commissioner.

In recognition of these facts, if understatements of taxable net income in returns are due to charging off depreciation in excess of an amount deemed reasonable by the Commissioner, negligence or intent to defraud will not be imputed to the taxpayer unless the position taken is so unreasonable as to indicate gross carelessness or bad faith.

It is recognized also that property, for example, manufacturing machinery, may be subject to extraordinary depreciation due to being operated overtime, at an overload, or being used for some purpose for which it is not adapted. Under such conditions, a taxpayer may deduct in addition to the amount measuring the depreciation under normal conditions, a further sum to provide for the extraordinary depreciation. It does not necessarily follow that if a machine operated normally for 8 hours a day, is operated for 16 hours a day, it will depreciate twice as rapidly as when operated under normal conditions. The estimate of the extraordinary depreciation should be made by the taxpayer according to his judgment and experience and will be subject to the approval of the Commissioner.

On account of the difficulty of estimating accurately the probable useful life of property, in many cases when the property is discarded and salvaged, the sum of the depreciation deductions and the salvage value may be greater or less than the original cost of the property. If such sum is less than the cost, the difference may be deducted as a loss; if such sum exceeds the cost, the excess must be reported as income; the adjustments to be made in the return for the year in which the property is discarded or salvaged. This refers only to differences within reasonable amounts and will not apply when the difference or excess is large or when, through negligence, carelessness, or fraud, the depreciation deductions have been insufficient or excessive. In such cases the Commissioner may require corrections to be made for prior years by means of amended returns and is authorized to assert penalties in cases of negligence, carelessness, or fraud.

If it develops at any time before property is discarded that the useful life of the property has been inaccurately estimated, the plan of computing depreciation should be modified and the balance of the cost of the property, or its fair market value as of March 1, 1913, not already provided for through a depreciation reserve or deducted from book value, should be spread ratably over the estimated remaining useful life of the property. Inasmuch as under the provisions of the income-tax Acts in effect prior to the Revenue Act of 1918 deductions for obsolescence of property were not allowed except as a loss for the year in which the property was sold or permanently abandoned, the taxpayer may for 1918 and subsequent years revise the estimate of the useful life of any property so as to allow for such future obsolescence as may be expected from experience to result from the normal progress of the art.

The rate of depreciation of a building is not based upon the number of years it would stand before being condemned and torn down, but is based on the number of years it would remain habitable and serviceable for the general purposes for which constructed or acquired. If A purchases for $10,000 a building having an estimated life at date of acquisition of 40 years, and at the expiration of 10 years sells the building to B for $6,000, in such case B should base his depreciation deduction on the purchase price and the estimated remaining useful life of the building at the date when he acquired it. Such estimated remaining life does not necessarily bear any relation to the estimate made by A, the former owner, and may be greater or less than 30 years.

Freight steamships on Great Lakes.—Three per cent is held to be a reasonable allowance for depreciation of bulk freight steamships on the Great Lakes; however, when due to peculiar conditions, it can be definitely determined that the established rate of depreciation will not be sufficient to return all of the capital invested, as at the date of acquisition, or March 1, 1913, whichever is later, by the time the vessel will be rendered useless, an addition to the regular rate to cover obsolescence may be allowed. The amount of this addition must be determined upon the basis of the facts in each particular case; that is, the type of vessel in question, the fitness for possible use in other lines of transportation, and the date when it can be definitely foreseen that the vessel will be no longer commercially useful in this particular line of traffic.

This rule does not necessarily apply to steamers engaged in other lines of traffic, for the reason that there are distinct differences in the method of construction and the manner of operation of package freighters and passenger steamers and the bulk freighters under consideration. (From Recommendation 27 of the Committee on Appeals and Review, published in full in Bulletin 9-20, p. 14.)

Repairs, replacements and improvements as affecting rate of depreciation.—The cost of incidental repairs which neither materially add to the value of the property nor appreciably prolong its life, but keep it in an ordinarily efficient operating condition, may be deducted as a business expense, provided the plant or property account is not increased by the amount of such expenditures. Repairs in the nature of replacements, to the extent that they arrest deterioration and appreciably prolong the life of the property, should be added to the property account or be charged against the depreciation reserve. The allowance for depreciation is intended to cover the estimated lessening in value of the original property, due to wear and tear, decay or gradual decline from natural causes, inadequacy, obsolescence, etc., which at some time in the future will require the abandonment or replacement of the property in spite of ordinary current repairs.

Accordingly, amounts paid for repairs are not allowable deductions if they are duplications of allowances for depreciation. It does not follow, however, that there may not be in the same case allowable deductions both for depreciation and payment for repairs. As a rule, property that has been subject to use even though maintained in serviceable condition by repair has a shortened expectancy of usefulness. In such case there may be a deduction for payments for repairs and also a deduction for loss due to depreciation of the property which occurred despite the maintenance of such property in repair.

The allowance for depreciation to which a taxpayer is entitled is the net depreciation for the taxable year. Losses by reason of exhaustion, wear and tear suffered during the taxable year, but made good by repairs during the year, are not included in such net depreciation. Nor can the taxpayer speculate as to the extent of the loss which he would have suffered if he had not arrested deterioration by repairs. The taxpayer is entitled to an allowance for the actual net depreciation suffered during the taxable year, and in addition thereto to an allowance for expenditures for ordinary repairs. He is not, of course, entitled to a deduction for amounts expended during one taxable year to make good depreciation suffered and allowed as a deduction in a previous year.

The amount expended by a taxpayer during any taxable year or period for improvements, replacements, or renewals of a permanent nature is a capital investment and is not deductible from his gross income for such taxable year or period. The amount so expended should be charged directly to the property account or to the depreciation reserve account, dependent upon how depreciation charges are treated in the books of account, and a pro rata portion thereof deducted as depreciation each year of the life of such improvements, replacements, or renewals.

METHOD OF COMPUTING DEPRECIATION ALLOWANCE: ACCOUNTING PRACTICE

The proper allowance which may be deducted from gross income for depreciation and obsolescence of property used in the trade or business is an amount which should be set aside by a taxpayer during each year of the useful life of the property according to a consistent plan by which the total of such amounts for the useful life of the property, together with its salvage value at the end of its useful life in the business, will provide in place of the property its cost or its fair market value as of March 1, 1913, if acquired by the taxpayer prior to that date.

A simple illustration follows: The X Manufacturing Company purchased a piece of machinery in 1914 for $4,275. Its estimated useful life in the business is 15 years, at the expiration of which time it will have a salvage value of $75. The annual deduction on account of depreciation would be $280.

Capital sum recoverable through depreciation allowances.—The capital sum to be replaced by depreciation allowances is the cost of the property in respect of which the allowance is made, except that in the case of property acquired by the taxpayer prior to March 1, 1913, the capital sum to be replaced is the fair market value of the property as of that date, and in the case of property acquired by gift, bequest, or devise, the sum recoverable is the fair market price or value of the property at the time acquired, or its fair market price or value March 1, 1913, if acquired prior to that date. In the absence of proof to the contrary, it will be assumed that such value as of March 1, 1913, is the cost of the property less depreciation up to that date. To this sum should be added from time to time the cost of improvements, additions, and betterments, and from it should be deducted from time to time the amount of any definite loss or damage sustained by the property through casualty, as distinguished from the gradual exhaustion of its utility, which is the basis of the depreciation allowance. In the case of the acquisition after March 1, 1913, of a combination of depreciable and nondepreciable property for a lump price, as, for example, buildings and land, the capital sum to be replaced is limited to that part of the lump price which represents the value of the depreciable property at the time of such acquisition.

The capital sum to be replaced by allowances for depreciation should be charged off over the useful life of the property, either in equal annual installments, this plan being generally known as the "fixed percentage" method, or, in accordance with any other recognized trade practice, such as apportionment over units of production. Whatever plan or method of apportionment is adopted must be reasonable and should be described in the return. The "fixed percentage" method as applied by the Commissioner contemplates that the annual depreciation deductions with respect to any property should be equal; that the rate of depreciation should be assumed to be uniform during the useful life of the property, as compared with the so-called "fractional method—weighted years," "declining balance method—scientific or unscientific," "revaluation method," and "sinking fund method," the use of which is advocated by accountants, but none of which have been approved in their entirety by the Commissioner for income tax purposes.

The only other method which has been approved by the Commissioner is an apportionment of the depreciation charges over the total amount of work to be performed or over units of production. For example, a contractor may purchase machinery for use only in performing a certain contract, which machinery will be worthless or have little or no salvage value upon completion of the contract on which he will be engaged for the whole of one taxable year and half of the succeeding taxable year. But the number of units of work, or percentage of completion accomplished during the first period of 12 months and during the second period of six months, may be equal. The contract may call for the making of an excavation, and the same number of yards may be excavated during each of the above periods. Under such circumstances, if the contractor returns his gross income each year on the basis of percentage of completion of the contract, he will be permitted to spread the total amount of the depreciation allowance equally over the two periods, deducting half of the total amount in his return for the first 12 months, and the other half in his return for the succeeding taxable period.

If the contractor had returned his income on some basis other than that of percentage of completion of the contract, it would have been necessary for him to modify his basis for computing the depreciation allowances. Thus, if the gross income was returned on the basis of time required for completion of the above contract, two-thirds of the gross income being reported in the return for the first 12 months, and the other third reported in the return for the succeeding period; in that case two-thirds of the total depreciation allowance would be deducted in the return for the first period and the remainder in the next return.

A lumber company contracts to cut and saw the timber on a certain tract of land, the estimated time required being two years. It erects buildings and installs equipment which by reason of prohibitive cost of removal will be worth only the salvage value upon completion of the contract. The cost of the property and equipment may be charged off and deducted as depreciation allowances on the basis of the time required to complete the contract, or in the proportion that the amount of timber cut and sawed each year bears to the total amount of timber available.

Who May Claim Deductions for Depreciation and Obsolescence

An allowance for depreciation and obsolescence may be claimed by individuals, citizen or alien, resident or nonresident; fiduciaries of estates and trusts, partnerships; corporations, domestic or foreign, including personal service corporations; associations, joint stock companies, and insurance companies, with respect to property actually used in trade or business and recognized by the Bureau of Internal Revenue as subject to depreciation or obsolescence or both.

Lessor and lessee.—Ordinarily an allowance for depreciation may be taken only on account of property owned by the taxpayer and used in trade or business and may not be taken on account of property of which he is merely the lessee. This will not preclude the deduction each year by the lessee of an aliquot part of the cost or the bonus paid for the lease. In the case of additions, improvements, or betterments to the property made at the expense of the lessee, which, according to the terms of the lease, revert to the lessor at the termination of the lease, the lessee may apportion the cost of such additions, etc., over the life of the lease and deduct an aliquot part thereof each year. If, however, the life of improvements for business purposes made at the expense of a lessee is less than the life of the lease, depreciation may be taken by the lessee instead of treating the cost as additional rent. Stockholders of a corporation are not entitled to deduct in their individual returns any amount on account of depreciation of the property of the corporation from which they receive dividends.

Fiduciaries or beneficiaries of estates and trusts.—An individual who receives income from a trust estate may not deduct from gross income in his individual income tax return any amount representing depreciation of property belonging to the estate. However, under the Revenue Act of 1918 it is permissible for the fiduciary in ascertaining the net income of the estate or trust for which he acts to deduct a reasonable allowance to cover the depreciation sustained during the taxable year, whether or not the terms of the will or agreement creating the estate or trust or a decree of court provide for taking care of the depreciation which may be sustained on the property held in trust.

Estates and trusts are under certain circumstances treated as a unit, and in other cases may represent an aggregate of distinct interests to all of which the fiduciary is responsible. Irrespective of whether the estate or trust is or is not treated as a unit, the fiduciary in computing the net income upon which he is required to pay the tax may claim a deduction for depreciation in accordance with section 214(a) 8 Revenue Act of 1918 and articles 161-171 Reg. 45. See also T. D. 2987.

Joint owners of property.—A joint owner of inherited property, collecting rents and profits from such property and managing the property on behalf of all the owners, pursuant to an oral agreement, is an agent and not a fiduciary. It is, therefore, necessary for each of the joint owners to file an income tax return and account for his share of the income from the property in addition to income received by him from other sources. In preparing such returns each joint owner may claim as a deduction for each year his proportionate share of the depreciation allowance for such year with respect to the property held in joint ownership.

Nonresident alien individuals and foreign corporations.—Nonresident alien individuals and foreign corporations may deduct an allowance for depreciation and obsolescence from gross income arising from sources within the United States only to the extent that such deduction is connected with such gross income.

Conditions of Allowance

Reduction in the value of property due to exhaustion, wear, and tear through use in trade or business is an actual fact, whether or not evidenced by book entries.

An allowance for depreciation and obsolescence must, however, be charged off by the taxpayer in his books and records in order to constitute an allowable deduction from gross income. The manner in which it is charged off is not material, except that the amount measuring a reasonable allowance for depreciation must either be deducted directly from the book value of the property or preferably credited to a depreciation reserve account, which should be reflected in the taxpayer's annual balance sheet. The allowance should be computed and charged off with express reference to specific items, units, or groups of property, and taxpayers should keep such records as may be readily verified.

The statement in the preceding paragraph to the effect that the depreciation allowance must be charged off before it can be deducted does not mean that depreciation sustained during one year may be charged out of the income of another year for income tax purposes; neither does it mean that failure to deduct depreciation before closing accounts for the year will prevent its ultimate deduction by the taxpayer. It means that if the taxpayer inadvertently neglected to make the proper entries on his books before closing them for the year during which the depreciation was sustained and failed to make the proper deduction from gross income in his return for that year, he may reopen his books, make the proper adjustment entries on them, and file an amended return showing the proper deduction for depreciation, provided bad faith or gross negligence was not shown in the preparation of his original return and in the manner in which he kept his accounts.

When the amount of depreciation charged off is credited directly to the property account, the value of the property appearing in a statement of affairs or a balance sheet will be its depreciated value, but subsequent deductions should nevertheless be computed on the basis of original cost or value as of March 1, 1913, as the case may be.

When the amount of depreciation charged off is credited to a depreciation reserve account the records of the taxpayer will show the original cost of the property when acquired while the depreciation reserve will be in the nature of a suspended credit to the property account.

Depreciation reserves.—Amounts deductible on account of depreciation should be credited to appropriate reserve accounts and carried as a liability against the assets to the end that when the total of these credits equals the capital investment account no further deductions on these accounts will be allowed.

While the presumption is that amounts credited to these accounts will be used to make good the loss sustained, either through a renewal or replacement of the property or a return of capital, there is no requirement of law that the funds represented by these reserve liabilities shall be held intact or remain idle against the day when they may be used in making good the depreciation of the property with respect to which the deduction is claimed or in restoring the capital invested in the depreciated assets.

The conversion of the depreciation reserve into tangible assets will not constitute such a diversion as would deny the taxpayer the right of deduction, provided in all cases that the deduction claimed in the return is reasonable.

A distribution made from a reserve for depreciation will be considered a liquidating dividend and will constitute taxable income to a stockholder only to the extent that the amount so received is in excess of the cost or fair market value as of March 1, 1913, of his shares of stock. No distribution, however, will be deemed to have been made from such a reserve except to the extent that the amount paid exceeds the surplus and undivided profits of the corporation.

Corporate taxpayers in some cases compute their net income for the taxable period without having made allowance for depreciation and then distribute the entire net income so computed to their stockholders so that the books show no surplus or undivided profits. In such cases if a corporation subsequently desires to avail itself of the privilege of deducting an allowance for depreciation in its return for such taxable period it must first reopen its books and make the appropriate charges as outlined on page 502. It will then be placed in the position of having paid a dividend from a depreciation reserve or from capital to the extent that the amount of dividend paid exceeds the true net income, meaning the net income *after* making proper charges for depreciation. The amount of the excess will be deemed a distribution in partial liquidation and taxed accordingly to the stockholders, and the invested capital of the corporation for excess profits purposes will be deemed to have been reduced to the same extent in accordance with article 860 of Regulations 45.

When Allowance Is Deductible

The deduction for depreciation and obsolescence allowable in the return for any taxable year or period is an amount sufficient to cover the reduction in value of property through exhaustion, wear and tear through use in the trade or business during such taxable year or period. The fact that depreciation and obsolescence have been sustained in prior years but were not claimed as a deduction in returns of net income will not warrant the deduction of an increased amount during the current year. The taxpayer's remedy lies in filing amended returns for prior years in which such deductions may be claimed and claims for refund of excess taxes paid.

On the other hand, excessive depreciation deductions are subject to disallowance by the Bureau upon audit of a taxpayer's returns. In such cases additional assessments of tax are made on the basis of the excessive deductions disallowed.

Delayed profit and loss adjustments.—Where common carriers during the year 1918 took up through their profit or loss account (pursuant to instructions of the Interstate Commerce Commission) "delayed" debit and credit items, such as allowances for depreciation sustained during the years 1912 to 1916, inclusive (the necessary data not having been available prior to the year 1918), it was held by this office that such credit and debit items should not be treated as part of the gross income and deductions therefrom in the return for 1918, but amended returns in which proper adjustments were to be made were required for the years affected.

Effect on Net Income and Tax

In all cases the amount of the depreciation allowance reduces the net income and consequently the amount of tax due. The gain derived or loss sustained from the sale of depreciable property also is affected by the amount of depreciation sustained, since in determining such gain or loss proper adjustment must be made for any depreciation sustained, it being immaterial for the purpose of the computation whether or not such depreciation has been deducted in returns of net income, except in the case of the sale of assets on account of which no depreciation deduction is allowable.

Furthermore, the invested capital of a corporation, association, joint-stock company, or insurance company is affected by depreciation, since in determining such invested capital under the Revenue

Act of 1918 proper adjustment must be made in surplus account for any depreciation sustained, regardless of whether or not any deduction for depreciation was made in returns for prior years. This was equally true under the Revenue Act of 1917 as to individuals, partnerships, and corporations.

APPENDIX E

DEPRECIATION RATES OF SPECIFIC ASSETS

Life of Old Structures

Any attempt to make an exhaustive list of assets and show their depreciation rates would require a volume of encyclopedic proportions and it is doubtful whether the results would repay the labor and expense of such a huge compilation. Depreciation rates are at best empirical, and no rate can be finally determined without giving consideration to factors which may be local in their influence. Nevertheless in seeking for the true rate recorded experience may be of much value for comparative purposes and it is for this reason that the following information relative to rates of depreciation of specific assets has been compiled.

Some structures, practically speaking, last forever, as is shown by the following list of properties compiled by the Valuation Committee of the American Society of Civil Engineers:

Main stone sewer, Rome	Built	600 B. C.
Arch bridge, San Angelo, Rome	“	200 A. D.
Several stone bridges at Nuremburg	“	1486-1728
Wooden bridge (Kapollsbrucke)	“	1333
Iron suspension bridge, Nuremburg	“	1824
Westminster Abbey, London, old portion stone	“	13th Century
Ratfield House, England (Marquis of Salisbury)	“	1611—Stone
Saint Lawrence Church (Nuremburg)	“	1477— “
South Church, Boston	“	1750—Brick
Church, Alexandria, Va.	“	1784— “
Howland House, Plymouth, Mass.	“	1660—Frame
Windmill, Nantucket, wood and shingles	“	1746— “
Washington's home, Mt. Vernon, Va.	“	1784— “
Hobson's house, Montgomery, Ala.	“	1815— “

But these structures are not required to meet the stress of business life and are not typical of business experience.

Depreciation Rate as Affected by Local Factors

The practice now becoming prevalent among associations of manufacturers and others of establishing uniform rates of depreciation has its commendable and its objectionable features. It is commendable in that it tends to uniformity in costs and requires careful consideration of the principles which govern depreciation. It is objectionable in so far as it makes impossible or unlikely the consideration which local factors require. The following extract from a paper by Thomas B. Gwynne is to the point:[1]

> The life of a machine or building is governed entirely by circumstances. The U. S. Government recognizes this and has no established rules for depreciation. As illustrations: an adding machine in a small office used perhaps half an hour a day might reasonably be given a life of 50 years, whereas the same kind of a machine working every minute of the day in a busy bank might reasonably be given a life of only 10 years; a building containing a printing press getting out a weekly paper might reasonably be given a life of 50 years (or more) while the same building (brick in both cases) containing a high-powered daily press turning out several thousand copies an hour might reasonably be given only a life of 25 years. Then again the policy of one mill man is always to be on the lookout for faster and better producing machines and to replace his current machines with them even though his current machines are practically brand new; while the policy of another mill man is to hang on to his machines to the last gasp. Obviously depreciation rates differ here. The progressive man might allot 10 years to certain machines whereas the non-progressive man might—and with reason—allot 30 years to similar machines.
>
> In other words so many factors enter into the useful lives of machines and buildings in all the various parts of the immense area of this country with its varying climatic conditions, that a universal rate of depreciation (amortization) is simply an impossibility.

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[1] *Administration,* May, 1921, p. 719.

The question of depreciation rates is one which involves many important considerations. Sometimes, as in case of some partnerships, the rates are fixed in the articles of agreement. Ordinarily, rates should vary between plants according to the attention given to repairs. Subdivision of plant for purposes of determining rates is usually desirable. The rate may be based on original cost, or it may be reckoned on the balance from the preceding year. It is sometimes desirable to supplement formal methods by actual physical valuations. Sometimes the depreciation allowance is determined as so much per unit of output, sometimes as a fixed percentage of profits. Matheson says that "iron smelters sometimes establish a special fund—say of one shilling or more per ton of pig iron made—and apply the fund to the maintenance and renewal of the whole plant of the furnaces."

Obsolescence and Inadequacy in the Determination of the Depreciation Rate

The depreciation rate may or may not cover obsolescence and inadequacy. The New Jersey Commission ruled that it should include these (Whitten, R. H., *Valuation of Public Service Corporations,* II, p. 1159). If a sinking fund is used and income from the fund is added to the principal the rate must be correspondingly reduced. Past policy of charging betterments and extensions to revenue may be a factor to be considered. The question whether or not depreciation not charged off during past years should affect present rates must be determined; ordinarily it should not. The Washington Supreme Court said: "Each year should carry the burden of its own wear and tear, and thus, when renewals become necessary, the burden is equally borne by all contributing features." (Whitten, R. H., I, p. 408.) This was supported by the United States Supreme Court in the *Knoxville Water Rate Case.* The Wisconsin Railroad Commission says:

> The allowance for depreciation will depend, to some extent, upon the practice of the company regarding its maintenance accounts. The distinction as to what are repair items and what is depreciation, is not always clearly drawn, and practice has differed as to just where the cost of certain renewals should be charged. . . . In a measure the expenditures for repairs and depreciation must complement one another and together be sufficient to maintain the property as closely as possible to its initial efficiency and value. (Whitten, R. H., I, p. 410.)

Sometimes depreciation rates are fixed by local franchises. The plan of a physical valuation each year is sometimes advocated but this is ordinarily too tedious and expensive.

The question whether or not the rate should cover obsolescence and inadequacy is one of extreme importance. Generally speaking, depreciation rates have been supposed to cover these as well as actual physical deterioration resulting from wear and tear. In most valuation cases this appears to have been the case, and this may be justifiable under certain conditions. It is the author's belief, however, that it is not only impossible but wholly undesirable to attempt to make allowance in the depreciation rate for either obsolescence or inadequacy. This follows from considerations which are fully explained elsewhere.[2] Not only is it unsound from a financial point of view to do so; it is also impossible for the simple reason that obsolescence and inadequacy cannot be foreseen for any considerable period of time. All depreciation rates should be based on the actual useful life of the asset, as if it would never be affected by obsolescence and inadequacy. Obsolescence and inadequacy only become effective when they lead to abandonment and this is a cost of replacement, not of past operations.

These fragmentary remarks are not meant to exhaust the subject but to serve as a warning against accepting published rates without giving careful consideration to the various factors involved.

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[2] See pp. 22-34.

Since considerable material on depreciation of specific assets is contained elsewhere than in this appendix the general index should be consulted.

Automobiles

R. H. Whitten in his *Valuation of Public Service Corporations* (Vol. I, p. 352), gives the life of automobiles as 10 years, but this is excessive under most conditions. Montgomery suggests 20% per annum in his *Income Tax Procedure,* 1918 (p. 373). In England 20% per annum, reducing balance method, is allowed on motor omnibuses for income tax purposes. The Treasury suggests a depreciation rate of from 20% to 25%, based on a life of 4 to 5 years, according to use.

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, places the useful life of automobiles at 10 years.

The Rulings Board of the Finance Department of the Bureau of Aircraft Production in March, 1918, during war times, ruled that 20% per annum be allowed on automobiles in computing contractors' reimbursements for normal depreciation.

Banks

Banks usually make very liberal allowances for depreciation, some making it a policy to write off the entire cost of premises over a comparatively short period of years. On December 14, 1918, the Federal Reserve Board sent the following instructions to all federal reserve banks:

> In order that there may be uniformity of practice, the Federal Reserve Board has approved for Federal Reserve Banks the adoption of the following rules for the treatment of depreciation and extraordinary charges against earnings

and profit and loss account at the closing of books December 31, 1918:

1. *Cost of Federal Reserve and Federal Reserve bank notes.*—Balance of account, as shown by books on December 31, to be charged to current expense account.

2. *Furniture and equipment account.*—Balance of account, as shown by books on December 31, to be charged to current expense account.

3. *Cost of vaults.*—(*a*) All expenditures made during the year 1918 for vaults and vault equipment to be charged to current expense account; (*b*) balance of account, as shown by books on December 31, 1917, to be charged to profit and loss account.

4. *Alterations and improvements.*—Charge against current expense account all expenditures made during the year 1918 in repairing, altering, or remodeling bank premises.

5. *Bank premises.*—(*a*) Where properties have been purchased with the intention of erecting new bank buildings, banks to be permitted to charge against profit and loss account an amount sufficient to cover the estimated value of buildings which will have to be razed, such estimated valuation of buildings to be submitted to the Federal Reserve Board for approval before depreciation allowance is determined.

(*b*) Where properties have been remodeled and are now used as permanent banking quarters by a Federal Reserve Bank, a reasonable depreciation charge will be permitted, but in no case shall it exceed 10 per cent of the estimated value of buildings on December 31, 1918.

(*c*) Where a Federal Reserve Bank has purchased, or may purchase, a site for a new building, it will be permitted to charge down the book value of premises now owned and occupied to a fair selling price, such price to be submitted to the Federal Reserve Board for approval before depreciation allowance is determined.

It is evident that the current books of banks do not correctly state taxable income. The Bureau of Internal Revenue says this is true because "furniture, fixtures, and improvements have been charged to expense account, and further for the reason that national bank examiners and State bank examiners have arbitrarily written down on the books of the banks, banking house furniture and fixtures." Since banks are not permitted to reopen their books and charge depreciation or adjust asset accounts (banking house, furniture and fixtures, etc.) the Bureau of Internal Revenue permits banks to keep separate books for income tax purposes which will enable them to file correct returns, these to be made up from the current books and necessary adjustments to be made thereon for depreciation. (*Committee on Appeals and Review Memorandum* 337, 5-21-1415.)

Boilers

R. H. Whitten in *Valuation of Public Service Corporations* (Vol. I, p. 352), gives life of boilers as 20 years. Dicksee allows from 12½% to 20% on the reducing balance. (Hatfield, H. R., *Modern Accounting,* p. 142.) In *Spring Valley Water Works v. San Francisco* (192 Fed. 137, decided Oct. 21, 1911), the district judge found the annual depreciation of boilers to be 5%.

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives the life of boilers as 20 years.

Bois D'Arc

Life given as 100 years by the Interstate Commerce Commission in *Valuation Docket No. 2* (p. 52).

Bridges

The Interstate Commerce Commission in its valuation of the Texas Midland Railway found the service condition for deck and Superstructure separately. It allowed 70 years as the life of metal parts. (See *Valuation Docket No. 2,* pp. 82, 128, 184.)

Bottle Manufacturers

The following rates have been adopted by the National Bottle Manufacturers Association:

	Annual Rate of Depreciation %
Buildings:	
Concrete or all steel	3
Mill construction	3–4
Ordinary brick	4–5
Frame	7½–10
Machinery and operating equipment:	
Steam and power plant	–10
Producer plant	–12
Mixers	–10
Tank (entire tank)	–10
Blowing machines	–15
Lehrs	–10
Conveyors	–10
Moulds	–25
Other machinery and equipment	–10

Buildings

See also "Dwelling Houses."

The following rates which were adopted by the Manufacturers' Cost Conference are quoted from Ficker's *Industrial Cost Finding:*

	Annual Rate of Depreciation %
Reinforced concrete or steel and tile	2
Brick and steel with non-combustible roof and concrete floors	2.5
Brick, steel, and wood	3
Brick and wood	3
Steel frame, wooden roof, and corrugated iron walls	3.5
Steel frame, non-combustible roof, and corrugated iron walls	3
Concrete block, with wooden roofs, floors	3.5
All-wood structures, cheap (20 years)	5
All-wood structures, well built (20 years)	4.5
Sprinkler system (20 years)	4

The following is taken from McKay's *Valuing Industrial Properties:*

	Life in Years	Authority
Buildings (brick)	66⅔	Henry Floy
Buildings (brick)	50	E. G. Connette
Fuel and water stations	25–50	H. P. Gillette
Grain elevators	33⅓	“
Miscellaneous buildings	33⅓	“
Masonry buildings	40–50	“
Railroad buildings:		
Brick (salvage value 8%)	33	Wm. Arthur
Concrete and stone (salvage value 8%)	50	“
Steel frame, brick and stone (salvage value 8%)	50	“
Shops—combination steel, iron and wood	25	“
Road department buildings	33	H. P. Gillette
Roundhouse and shops	33	“
Transportation department buildings	33	“
Wooden frame railroad station buildings	33	“
Buildings, fireproof	50	C. W. McKay
Buildings, slow-burning	30	“
Buildings, non-fireproof	15	“

The following is taken from Kimball's *Cost Finding:*

	Life in Years
Brick or steel frame buildings, easy service	40
Brick or steel frame buildings, severe service	20
Good wooden buildings, easy service	30
Good wooden buildings, severe service	15

The following is from Nicholson and Rohrbach's *Cost Accounting,* and is said to have been adopted at various conferences of a large manufacturing enterprise:

	Annual Rate of Depreciation %
BUILDINGS:	
Housing:	
Dwellings—frame	3
Tenement houses	5
Hotels	5
Fire-proof:	
Concrete	2
Brick	2½
Brick and concrete floors	2½
Main buildings—brick and concrete	2–2½
Steel frame—non-combustible roof, and corrugated iron walls	3
Steel with corrugated sheet iron or steel plate	5
Corrugated iron—steel frame concrete floor	3
Reinforced concrete, or steel and tile	2

	Annual Rate of Depreciation %
Stone, brick, concrete with or without steel, first-class stone and brick	2
Mill or slow-burning buildings—brick, steel, and wood, or brick and wood	3
Non-fire-proof:	
Outbuildings	7½
Wood	5
Substantial wooden buildings	5
All-wood structures—well built	5
All-wood structures—cheap material	7½
Steel frame—wooden roof, and corrugated iron walls	5
Steel or corrugated sheet iron with wood	5
Corrugated iron—wood frame and floor	5
Corrugated iron—wood frame, concrete floor	5
Corrugated iron—steel frame, wood floor	5
Concrete block with wooden roofs and floors	5
Miscellaneous structures:	
Hose reel and guard houses	15
Pine swamp (magazines)	2
Frames, stables, and sheds	5
Bins—concrete and brick	5
Bins—wood alone	20
Trestles—steel (not including rails or ties)	3⅓
Trestles—wood (not including rails or ties)	6⅔
Docks, piers, and wharves	3⅓
Dry docks—basin	2
Dry docks—floating	5
Ship sheds	3⅓
Fences—wooden	10
Fences—wooden and wire mesh	8⅓
Pump	5
Retaining walls	2–5
Tunnels, underground piping, vaults, and general conduits	5
Stack—brick	3
LAND:	
Dams and waterways	1½
Roadways and sidewalks	4
Paving and pavements	4–10
Wells—gas	10
Wells—water	3

The following is from Ficker's *Industrial Cost Finding:*

Construction	From Investigation by	Life in Years
Wooden	Pacific Gas & Elec. Co.	20
Wooden	Rosecrans	25
Corrugated iron:		
Wooden frame and floor	Pacific Gas & Elec. Co.	20
Wooden frame and concrete floor	" " " " "	25

Construction	From Investigation by	Life in Years
Steel frame and wood floor	Pacific Gas & Elec. Co.	30
Steel frame and concrete floor	" " " " "	36
Brick:		
Wood roof, wood floor	" " " " "	30
Slate roof, wood floor	" " " " "	36
Corrugated iron roof, concrete floor	" " " " "	40
Slate roof, concrete floor	" " " " "	50
Reinforced concrete roof: concrete floor	" " " " "	50
First-class stone and brick	Wisconsin R. R. Comm.	75
Fire-proof	Chicago Telephone Co.	40
Reinforced concrete roof: concrete floor	Pacific Gas & Elec. Co.	50
Tools and shop machinery	Cooley	12½
Tools and shop machinery	Starrett	14.2
Tools and shop machinery	Milwaukee E. R. & L.	13.3
Tools and shop machinery	Chicago U. T. Co.	20
Tools and shop machinery	Stone & Webster	20

Henry R. Brigham, in the *Atlantic Monthly,* March, 1921 (p. 408), estimates the depreciation of dwelling houses at 3% per annum. He says, however, that this item varies "largely according to local conditions and the quality of construction of the buildings." This percentage was confirmed by a study made by means of questionnaires sent to realtors all over the country by the United States Housing Corporation.

Against a gross valuation of real estate and buildings of $56,098,327.09 the General Electric Company, according to its 1920 annual report, carried reserves of $17,128,427.05.

R. H. Whitten mentions 50 years and 25 years as the life of buildings under different conditions. (*Valuation of Public Service Corporations,* I, p. 352, and II, p. 1145.)

The following quotation is from a federal bulletin on depreciation restricted in application to Form 1040 A:

> Under question 99 of the Income Tax Primer of 1918 an estimate is made of the probable useful lifetime of certain kinds of buildings. It is estimated that the average life of a frame building *"without repair or replacement"* is 25 years; of a brick building, 35 years; of a stone or steel and concrete building, 50 to 100 years. It is also estimated that the

lifetime of ordinary machinery is 10 years, that of automobiles used for business or farm purposes and farm tractors, 4 to 5 years.

Therefore, wherever the cost of repairs is not known or is so thoroughly inter-mixed with replacements as to be inseparable the flat rate of 4% for frame and 3% for brick buildings will, under ordinary conditions, cover both repairs and depreciation. In other words, the estimate of 25 years for a frame and 35 years for the life of a brick is based on the assumption that they are not being kept in repair.

But property kept in repair will, of course, be subject to a longer life because the weaker parts of the building are continually being bolstered up and made to last as long as the strongest parts. And as a matter of correct accounting, where the cost of repairs is known, it is preferable to charge both the repairs and a reasonable and steady allowance for depreciation. This is permitted by article 162 of the regulations previously quoted that "Property kept in repair may, nevertheless, be the subject of a depreciation allowance." The accounting truth is recognized that no repairs can wholly offset depreciation. Repairs do in fact offset the depreciation of a part (that particular part to which they have been applied) but they cannot offset or arrest the depreciation of the whole.

. . . .

It will be found, that if kept in repair, under ordinary conditions the rate of depreciation on a frame building should be 2½% (based on a life of 40 years) and the rate of depreciation on a brick building should be 2% (based on a life of 50 years). Where, however, repairs are not claimed a rate of 4% (or 25 years) for frame and 3% (or 35 years) for brick should be allowed.

Of course, it will be remembered that the basis here set is for standard cases occurring under standard conditions. As the law and regulations intend that each individual case shall be decided on its own individual merits it is plain that any case that is affected by any unusual condition must be given an individual consideration and an individual solution. For example, buildings, in a flood district, which were subject to being flooded once or twice a year must be allowed

> an added rate of depreciation equal to the amount of this unusual wear and tear. Buildings (and, of course, machinery or other property) which are subject to unusual wear and tear by the nature of the business in which they are employed should have this fact reflected in the rate of depreciation allotted to them.
>
> . . . .
>
> Reverting to the subject of depreciation through wear and tear, it should be remembered by the deputy that because the rates of 2½% on a frame building and 2% on a brick are herein mentioned as covering ordinary conditions, that it is not possible under the same conditions for the actual percentage rate to be higher. Many deputies make no adjustment for the fact that a building may have been purchased by the taxpayer after it was already quite old. But it is evident that if a brick building, which was constructed for $5,000 and was expected to last 50 years, if purchased by the taxpayer after it is 30 years old that he cannot expect the building to last more than another 20 years. The price which he pays for the building which is 30 years old will not be nearly as great as the original cost. Therefore, to give him a rate of 2% on this later value merely because the construction is brick would not conform to the regulations which require that the remaining life shall be taken into consideration. If he purchased the house for $2,000 it is evident that on this new cost price he should be allowed 5%, which recognizes that the low value of $2,000 reflected the fact that the building would only last 20 years. It can readily be seen that for this building to allow 5% on $2,000 results in no greater charge than to allow 2% on its original cost of $5,000.

The Rulings Board of the Finance Department of the Bureau of Aircraft Production, in January, 1918, ruled to allow 2½% per annum on main buildings constructed of brick and concrete in determining costs under the cost-plus contracts. On substantial wooden buildings it allowed 5%. (*General Ruling No. 4.*)

The Treasury Department has ruled that for income tax purposes buildings under construction are not subject to a depreciation allowance.[3] This is correct because such depreciation is a capital cost.

Building Materials

The following is taken from Ficker's *Industrial Cost Finding:*

	Per Cent on Cost
Heating and ventilating system (20 years)	4
Water and sewer piping and sanitary fixtures (where separate)	4
Tanks and reservoirs, steel	4.5
Tanks and reservoirs, wood (20 years)	9

The following is from McKay's *Valuing Industrial Properties,* Redford being cited as authority:

	Life in Years
Base-boards	40
Building hardware	20
Cornice	40
Dimension lumber	50
Doors	30
Flooring	20
Flooring (entirely carpeted)	40
Inside blinds	30
Outside blinds	16
Painting (inside)	7
Painting (outside)	5
Piazzas and porches	20
Plastering	20
Sheathing	50
Sills and first joists	15
Shingles	16
Stairs and newels	30
Weatherboarding	30
Windows, complete	30

The following is from the same work, citing Kidder's *Architects' and Builders' Pocket Book* as authority:

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[3] *Office Decision* 845, 11-21-1510.

Material	Frame Dwelling	Brick Dwelling	Frame Store	Brick Store (Shingle Roof)
	AVERAGE LIFE IN YEARS			
Brick		75		66
Plastering	20	30	16	30
Painting, outside	5	7	5	6
Painting, inside	7	7	5	6
Shingles	16	16	16	16
Cornice	40	40	30	40
Weather-boarding	30	..	30	..
Sheathing	50	50	40	50
Flooring	20	20	13	13
Doors, complete	30	30	25	30
Windows, complete	30	30	25	30
Stairs and newel	30	30	20	20
Base	40	40	30	30
Inside blinds	30	30	30	30
Building hardware	20	20	13	13
Piazzas and porches	20	20	20	20
Outside blinds	16	16	16	16
Sills and first-floor joists	25	40	25	30
Dimension lumber	50	75	40	66

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
Plumbing:	
Inside piping, and water and sewer piping	6
Heating and ventilation	5
Sprinklers	5
Electric light and power wiring:	
Departmental wiring—net additions	6
Inside wiring	5
Elevators	5–7½
Fire alarm and fire prevention apparatus	5
Refrigeration	7½

Cars

In the *Chicago Union Traction Case* (1902) 6% annual depreciation was allowed in determining net earnings. (Whitten, R. H., *Valuation of Public Service Corporations,* I, p. 424.)

The Interstate Commerce Commission in *Valuation Docket No. 2* (Texas Midland) says at page 52:

This testimony does not state the exact fact. Cars do go out of service, but it is true that ordinarily a new car of the same type would not be ordered to replace the old car. In other words, cars are ordinarily sent to the scrap heap because they are obsolete or inadequate rather than because they can not be repaired.

That this fact is fully recognized by the bureau in its depreciation methods will be seen by observing the manner in which a *car*, for example, is depreciated. While the life of the car itself may be indefinitely prolonged, the different parts of that car wear out and must be replaced. The car is therefore divided into three such parts, the trucks, the underframe, and the body, and each one of these parts is depreciated by itself. The three are then combined into a weighted average from which the condition per cent of the car is determined. The weighted average may be taken itself as the condition per cent or may be reduced if the type of the car is such that its use will not be continued in the future.

Cement Industry

The following mortality table, which shows the average estimated life of various properties used in the cement industry, has been adopted:

MACHINERY:	Life in Years
Quarry:	
Locomotives	13
Tracks and cars	9
Steam shovels	11
Dredges	11
Drills—well	9
Drills—tripod	7
Livestock	8
Carts and wagons	7
Cable-way	9
Raw Department:	
Crushing machinery	14
Dryers—upright	11
Dryers—rotary	11
Slurry tanks	16
Grinding machinery	13

	Life in Years
Clinker Burning Department:	
Kilns	13
Coolers—upright	12
Coolers—rotary	13
Clinker Grinding Machinery	12
Coal Mill:	
Dryers	11
Grinding machinery	14
Power House:	
Boilers	15
Engines	17
Generators	16
Motors	14
Stock House Machinery	10
Machinery and B. S. Shop Machinery	15
Buildings:	
Mill:	
Concrete	50
Steel and corrugated iron	33
Steel and stucco	35
Steel and brick	40
Timber	20
General (Mill Office, Laboratory, Store House, etc.):	
Concrete	60
Steel and corrugated iron	40
Steel and stucco	45
Steel and brick	50
Frame	30
Frame and stucco	33
Dwellings:	
Concrete	60
Brick	50
Frame	30
Frame and stucco	33

Containers

R. H. Montgomery in *Income Tax Procedure,* 1917 (p. 211), says no specific rate of depreciation can be fixed, but that at balancing time an inventory should be taken. Allowance should be made for those in the possession of customers which may not be returned. Containers comprise corks, kegs, bottles, cases, tins, and so on used by breweries, bakers, water dealers, and the like.

Copyrights

A federal bulletin applicable to income tax Form 1040 A says:

> Intangible property such as patents, copyrights, licenses, and franchises, if they are of limited life may be considered subject to a depreciation allowance. These items are usually carried at a value which is a great deal more than their actual cost to the owner. The depreciation allowance, however, must be determined by dividing only the actual cost by the number of years the special rights will last. The depreciation in this case is not really due to exhaustion, wear and tear, nor to obsolescence. It is in fact the gradual absorption of a deferred charge, an item which the law recognizes in its entirety as an expense, but which (because of the length of time covered by the benefits received) it would not have been fair to charge wholly against the first year of operation.

R. H. Montgomery suggests that the depreciation of copyrights should not be based on their life, which is 42 or 50 years after the author's death, because they usually diminish rapidly in value. He suggests that the revaluation of each copyright is the only satisfactory method. (*Income Tax Procedure,* 1917, p. 212.)

Culverts

In one railroad case 8 years was the assumed life. (Whitten, II, p. 1145.)

The Interstate Commerce Commission assumes the life of culverts to be 100 years in the Texas Midland valuation. (*Valuation Docket No. 2,* p. 184.)

See also "Bridges."

Drug Stores

The following is quoted from an article by Professor W. A. Paton entitled, "The Drug Store's Overhead," which appeared in the September, 1920, number of the *American Druggist:*

> The retailer has, until very recent years, commonly given no formal recognition in the accounts to accrued deprecia-

tion of fixed assets. Most business men, spurred thereto by high income and profit taxes, are now recognizing this element of expense. It is not very important in the drug business; and the widest variation is found in the percentages allowed. Recognized depreciation of store and equipment in the drug store varies from one-half to 8 per cent. of gross sales and from 2 to 30 per cent. of total overhead. The writer's data on this subject is so limited that he is unwilling to risk a statement as to what is the representative percentage. In any case it should be noted that the percentages given have no bearing on the question as to what percentage of cost of store and equipment should be charged to operation each period. The Bureau of Internal Revenue considers 2 to 3 per cent. on brick buildings, 3 to 5 on frame structures, and about 10 per cent. on store fixtures, as reasonable annual rates in determining allowable depreciation charges for tax purposes.

Repairs is another item not listed in the above table. The size of this item, as was just stated, depends to a considerable degree upon whether or not the druggist is operating in leased premises. Maintenance of equipment totals from one-tenth to a half per cent. of gross sales, with one-third per cent. fairly typical. Replacements of broken dishes, prescription implements, etc., are sometimes charged to this account.

Dwelling Houses

See also "Buildings."

The New York State Income Tax Bureau allows 4% on frame and 3% on brick buildings. This covers both repairs and depreciation.

A New York court has recently handed down a decision interpreting the phrase "reasonable rent" used in the New York law regulating rents. Among the allowable operating expenses the court provided for an annual depreciation charge which "if established by fair proof, should be made on the fair market value of the buildings." The court said, in part:

> The great weight of evidence is that an annual charge of 2 per cent. per year for depreciation of the value of the building is fair. The Federal and State governments allow such depreciation in the calculation of income tax.

The court also passed upon the question of repairs of a kind which may be called replacements. In the case in question new sections had been added to the boiler and new flooring, electric wiring, plumbing, and awning had been installed. These were said by the court to be current repairs and therefore properly deductible as operating expenses. The court added, however, that:

> There are, of course, instances where buildings are largely remodeled and rebuilt, where the improvements should be charged to increase of capital; but the items here for review are not of that character, nor is the Court impressed with the argument that repairs should be spread over a period of years and charged against future income. (*New York Times,* Sept. 1, 1921.)

This decision departs from the practice of basing the depreciation charge on cost, which is the policy of the federal government, and is too liberal in permitting the entire cost of improvements to be charged currently as expenses. As the decision will be appealed these requirements may be altered in a higher court.

Electrical Manufacturing Industry

The following extract is from the standard accounting and cost system of the electrical manufacturing industry:

DETERMINATION AND APPLICATION OF RATES FOR DEPRECIATING MANUFACTURING PLANT ACCOUNT

I. GENERAL

1. All rates are to be applied to first cost.
2. The rates recommended are those which are to be applied to first costs, to obtain amount to be included in costs and estimated costs, and are in addition to maintenance expenditures and re-

newals as provided for in indirect manufacturing expense accounts.

3. All rates recommended are based on normal costs and operating conditions. In case of a factory working overtime and with night shifts for any appreciable length of time, or under other extraordinary conditions, or in cases of facilities acquired at excessive costs, higher rates should be assessed so as to absorb in the costs during the period of extraordinary activity:
    1. The abnormal physical exhaustion.
    2. The abnormal primary cost of buildings and structures.
    3. The cost of equipment estimated to be surplus in normal times.
4. Rates recommended are to be applied to the items shown in the further subdivisions of the manual, Section 3, sheet 2.

	Rate Recommended %
A. LAND	
Land—purchase price	0
Land—grading and improvements	0
B. BUILDINGS	
a. Buildings (total reserve 75%):	
Wooden buildings and sheds	10
Corrugated iron buildings	10
Brick and wood (mill construction)	5
Brick and steel (fireproof construction)	3
Reinforced concrete (fireproof construction)	3
NOTE.—In those cases where plant accounts include accessories, care should be taken to segregate such accessories, in order that the proper rates of depreciation may be applied.	
b. Structures (total reserve 90%):	
Structures	12½
Water, drainage and sewer pipes (outside)	6
Piping and electrical conductors (outside)	6
c. Sprinkler system (total reserve 90%)	5
d. Heating and ventilating and other inside piping and wiring (total reserve 90%):	
Heating and ventilating	5
Other inside piping and wiring	5
C. MACHINERY AND TOOLS	
a. Machinery (total reserve 90%):	
Special machinery	7½–90
Rates on special machinery depend upon the estimated present use and their adaptability for other use.	
Standard machinery	7½–10
Electrical apparatus	7½–10
Ovens and furnaces	10
Power plant equipment	7½

b. Machinery—foundations and installation (total reserve 100%):

Foundations for machinery and apparatus	12½
Installation of machinery	12½

		Years to be Applied
c. Semi-durable tools and instruments (total reserve 100%):		
Semi-durable tools, 25% on each year's expenditures		4
Set up on the books an estimated value equivalent to the additions to the account during the last 4 years.		
Electrical equipment, 16⅔% on each year's expenditures		6
Molds, jigs, punches, dies, and special tools, 33⅓% on each year's expenditures		3
Metal flasks:		
Inasmuch as all foundries have their proper equipment of metal flasks, the cost of making all metal flasks is to be charged to indirect expense account No. 460. When flasks are scrapped, the scrap value will be credited to indirect expense account No. 460. The difference between the inventory at scrap value at the beginning and the end of the year will be taken in the expense account. There will, therefore, be no depreciation on this item.		
D. Patterns and Drawings (total reserve 100%)		
a. Patterns, 33⅓% on each year's expenditures		3
b. Drawings:		
Set up on books estimated or appraisal value. Expenditures chargeable to development or shop supplies account No. 240.		
E. Furniture, Fixtures, and Appliances (total reserve 100%)		
a. Furniture and fixtures in shops	20% on each year's expenditures	5
b. Furniture and appliances in factory offices		
c. Fire protective apparatus		
From a valuation viewpoint, it is recommended that 100% reserve be set aside.		

Set up on the books a value obtained by inventory where practicable. Where this method is impracticable, a value should be set up on basis of previous year's additions, the number of such years being dependent upon the varying circumstances.

F. Other Equipment (total reserve 90%)

Railway tracks and overhead equipment; renewals and repairs charged to operating expense	None
Rolling stock	3–6
Automobiles and other conveyances	25

II. Property Other Than Manufacturing Plants

The rates recommended are those that would be applied for similar items for manufacturing plant items. In case items are dissimilar, rates should be applied consistent with those used for manufacturing plant items.

The accounting procedure for absorbing depreciation in manufacturing cost is explained in the supplementary manual referred to in sheet 2 of this section.

Electric Plants

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
Electric Plant Equipment:	
Dynamos	5
Electric machinery—generators	5
Electric machinery—motors	5½
Electric motors and apparatus	10
Storage batteries	6
Substation equipment	5
Switchboards—telephone central	5
Switchboards—telephone P. B. X.	7½
Switchboards and wiring	5
Switchboards, main wiring, and conduit	5
Aerial lines	5
Cables—underground (high tension)	5
Electric wiring	5
Conduits	2
Conduits, manholes, and paving	5
Transformers—station service	5

The following is from Barker's *Public Utility Rates:*

	Life in Years	Authority	Cause
ELECTRICITY-SUPPLY WORKS			
Anchors and guys	10–20	Wisconsin R. R. Comm.	D.
Arc lamps and hangings	10–15	“ “ “ St. Louis P. S. Comm.	D. & O.
Belting	20–25	Wisconsin R. R. Comm.	D.
Boilers:			
Fire-tube	10–15	“ “ “	D.
Water-tube	20–30	“ “ “	D.
Buildings:			
Masonry	75	“ “ “	O.
Wooden-frame or second-class	50	“ “ “	D. & O.
Chimneys and stacks:			
Masonry	30	Barker	
Steel	10	“	
Condensers	20–30	Wisconsin R. R. Comm. Chicago Trac. Val. Comm.	D.
Conduits and manholes	30–50	Wisconsin R. R. Comm.	O.
Conveyors:			
Coal or ash	10	“ “ “	D.
Ash or combined coal and ash	5	Barker	D.
Cross arms	10–15	Wisconsin R. R. Comm.	D.
Engines:			
Gas	10–15	“ “ “	D. & O.
Steam, high-speed	15–20	“ “ “	D.
Steam, slow-speed	25–30	“ “ “	D. & O.
Feed-water heaters	20–30	“ “ “	D.
Fuse boxes	10–12	“ “ “	D.
Fuel-oil equipment	25	Chicago Trac. Val. Comm.	D.
Generators, motors and converters:			
High-speed	15	Barker	D.
Slow-speed	20	“	O.
New types	20	Wisconsin R. R. Comm.	D.
Old types	15	“ “ “	O.
Turbine driven	20	“ “ “	D.
Lightning arresters	15–20	“ “ “	D.
Piping and covering	20–30	“ “ “	O. & D.
Poles:			
Cedar in concrete	12–18	“ “ “	D.
Cedar in earth	10–18	“ “ “	D.
Iron or steel in concrete	15–30	Barker	O. & D.
Iron or steel in earth	10–15	Wisconsin R. R. Comm.	D.
Reinforced concrete	50	Barker	O.
Pumps:			
Boiler feed	15–20	Wisconsin R. R. Comm.	D.
Small centrifugal	20–30	“ “ “	D.
Service boxes	10–12	“ “ “	D.
Shafting	20–40	“ “ “	O.
Station wiring, etc.	30	“ “ “	O. & D.
Stokers	20	Chicago Trac. Val. Comm.	D.
Storage batteries	15	Wisconsin R. R. Comm.	D.

	Life in Years	Authority	Cause
ELECTRICITY-SUPPLY WORKS			
Switchboard instruments and wiring	25–30	Wisconsin R. R. Comm.	O. & D.
Switchboards, old types	20–30	“ “ “	O.
New types	15–20	“ “ “	O.
Turbines:			
Hydraulic, old types	25–40	“ “ “	O.
New types	30–50	“ “ “	O.
Steam, large units	20	“ “ “	D. & O.
Auxiliary units	10–20	Barker	D. & O.
Transformers:			
Consumers	10–15	“ “ “	D.
Station and substation	20	“ “ “	O. & D.
Watt-hour meters (consumers)	10–15	“ “ “	D.
Wire:			
Insulated copper line	10–15	“ “ “	D.
Lead-covered aerial cable	10–15	“ “ “	D. & O.
Lead-covered underground cable	20–25	“ “ “	O.

NOTE: D. denotes depreciation. O. denotes obsolescence.

The Arizona Commission allowed 3½% on depreciable property of electrical companies in 1913. The California Commission allowed 3% on the value of property in 1913. (Whitten, R. H., II, p. 1189.) The Nevada Commission allowed 5% in a mining camp in 1913. (Whitten, II, p. 1196-97.) In 1912 the Wisconsin Commission allowed 4½% on reproduction cost new. (Whitten, R. H., II, p. 1203.) In New York a committee formed to report on statistics and accounts of public utility companies advocated a minimum rate of depreciation of 3½% on the entire fixed capital of electric companies. The English Inland Revenue allows 3% on the reducing balance on cables and 5% on the reducing balance on plant and machinery.

The New York Committee on Statistics and Accounts of Public Utility Companies suggested a tentative rate of 3½% on the entire fixed capital of electric companies.

Electric Railways

The following is taken from Barker's *Public Utility Rates:*

Electric Railways	Life in Years	Authority	Cause
Bridges (see Railways)			
Cars	30	B. J. Arnold	D.
Car bodies:			
Open type	25	Chicago Trac. Val. Comm.	D.
Closed type	20	“ “ “ “	D.
Trucks	30	“ “ “ “	D.
Motors	5	Wisconsin R. R. Comm.	
		H. Floy	D.
Misc. elec. equipment	10–15	Barker	D.
Feeder conduit	30–50	Wisconsin R. R. Comm.	O.
Feeders, insulated aerial	10–15	“ “ “	D.
Overhead construction:			
Trolley wire, No. 0, 1 min. headway	2	“ “ “	D.
Trolley wire, No. 00, 1 min. headway	2½	“ “ “	D. Reduced
Trolley wire, No. 000, 1 min. headway	3	“ “ “	25% in size
Single catenary support	15–20	Barker	D.
Double catenary support	20–25	“	D.
Cross spans and brackets	15–20	Wisconsin R. R. Comm.	D.
Poles:			
Cedar in earth	14	“ “ “	D.
Wood in concrete	20	“ “ “	D.
Iron or steel	40	“ “ “	D.
Power station equipment (see Electricity-Supply Works)			
Track:			
Tangent	18	“ “ “	D.
Curves	5	Barker	D.
Special work	5	“	D.
Trestles (see Railways)			

Note: D. denotes depreciation. O. denotes obsolescence.

The New York Public Service Commission for the First District, in 1912, in a case involving an accounting order issued subsequently to the approval of an issue of securities after reorganization, ordered the Third Avenue Railway Company of New York to reserve at least 20% of its operating revenues for depreciation. A similar requirement was prescribed for the Metropolitan Street Railway Company. Its successor, the New York Railways Company, contested the order. The Commission's order was upheld by the Appellate Division of the Supreme Court, First Department, but on May 4, 1918, the Court of Appeals reversed the lower court on the ground that the order was beyond the power of the Commission. No question was raised as to the reasonableness of the 20% allowance, however.

In the *Chicago Street Railway Assessment Case* (1902), it was ordered that 6% should be deducted as depreciation on cars, tracks, and machinery in order to arrive at net income.

In the *Savannah Street Railway Fare Case* (1912), the Georgia Railroad Commission gave 3% of the total valuation of the physical properties of an electrically operated city and suburban street railway system as a fair and reasonable allowance to cover depreciation and obsolescence.

In the *Columbus, Ohio, Electricity Rate Case* (1906), the special master reports 5% of total cost of plant including real estate, where the real estate is nominal in amount, as a fair depreciation rate.

Electrotypes

These should be charged monthly as the direct cost of a first printing, and the amount remaining charged to the account should be carefully revised at the close of each fiscal year. A successful book will bear writing off of the entire cost of such plates against the first edition, while if the book is unsuccessful there can be no excuse for retaining such items as assets.

Engineering Costs

Engineering Board Memorandum No. 226 (as revised November 6, 1915) incorporated in Interstate Commerce Commission *Valuation Docket No. 2* (Texas Midland) reads in part:

> A small portion of the expenditure for engineering is connected with property which depreciates. In view of the fact that the larger portion is expended on location surveys, grading, and other property which does not depreciate, and

that the accounting records have been so kept in the past as to make it impracticable to segregate that portion of the expenditure which depreciates, the service-condition per cent of the account shall be considered at 100.

Engines

Dicksee allows from 10% to 12½% for depreciation on engines on the reducing balance. (Hatfield, H. R., *Modern Accounting,* p. 142.) At a conference consisting of representatives of the United States Bureau of the Census, the American Water Works Association, the New England Water Works Association, the American Association of Public Accounting, and others, a uniform system of accounts for water supply systems was adopted in 1911 which assumed the life of engines, pumping machinery, and wood pipes to be 25 years. In a California case, *Spring Valley Water Works v. San Francisco* (192 Fed. 137, decided October 21, 1911), the district judge found the annual depreciation of pump engines, flumes, and wooden structures to be 2.5% per annum. (Whitten, R. H., I, p. 430.)

Envelope Manufacturers

The following rates of depreciation have been adopted by the Bureau of Envelope Manufacturers of America:

	Annual Rate of Depreciation %
Steam and power plant	10
Printing presses	10
Platen cutting and creasing presses	10
Die cutting presses	7½
Straight knife cutters	7½
Slitters	7½
Solid cutting dies	33⅓
Plunger folding machines	10
Open end folding machines	10
Panel patching machines	10
Machine gummers	10
Clasp and tension machines	15
Gum cooking equipment	10

	Annual Rate of Depreciation %
Box department machines	10
Machine tools	10
Electric motors	10
Automobile trucks	25
Factory furniture and fixtures	10
Office furniture and fixtures	10
Type and electros—will be charged to expense at purchase cost, instead of being capitalized and then depreciated.	

Farm Property

The following quotation is from the *Income Tax Primer for Farmers,* issued by the Treasury Department, and dated January 1, 1921:

> What is depreciation?
>
> Depreciation is a lessening in value of farm buildings, machinery, etc., employed in the business arising from wear, tear, or obsolescence.
>
> At what rates may depreciation be claimed, and under what conditions?
>
> The annual allowance for depreciation should be based upon the life of the property; that is, the cost of the property or the value of the same when acquired, if received by gift or bequests, or its fair market price or value as of March 1, 1913, if acquired prior thereto, should be ratably spread over its life. For instance, the rate of depreciation to be deducted on buildings used for business purposes the probable life of which is 50 years would be 2 per cent. The probable life means of course the number of years the property would be usable in business if ordinary repairs are made from the date of acquisition or in case of property acquired prior to March 1, 1913, the number of years the property would be usable from March 1, 1913. In the case of property acquired by gift or bequest, the "cost" of such property for depreciation purposes is the appraised value at the time the property was acquired. If property in respect of which depreciation is claimed was acquired prior to March 1, 1913, the fair market value as of that date will be assumed to be, in the absence of

proof to the contrary, the cost of the property, less depreciation up to that date.

In claiming depreciation the following fundamental principles must be taken into consideration:

(*a*) Only such depreciation as results from exhaustion, wear and tear of property, arising out of its use or employment in business or trade, can be claimed. Depreciation in the value of a home or any article of property, such as automobiles, used for personal pleasure or convenience, can not be claimed; the property must be used for the purpose of producing income.

(*b*) Depreciation in the value of land, whether improved or unimproved, due to ordinary erosion, exhaustion, or any other cause, can not be claimed.

(*c*) Where, in the course of years, the owner of property has claimed its full cost as depreciation in his income-tax returns, no further claim will be allowed.

(*d*) The value to be cared for by depreciation is the actual amount invested in the property and not the value which may be arbitrarily or otherwise fixed.

What is the usual depreciation allowed on general feed mill machinery, mill building, electric light plant, and frame building combined?

As the rate at which depreciation may be claimed is dependent to a greater or less extent upon local conditions, the use to which the property is put and its probable life under normal business conditions, no rates applicable to all classes of property have been established, and no specific rates can be given at which depreciation may be claimed with respect to any particular property.

What is the depreciation on gasoline engine?

The rate of depreciation which may be claimed on a gasoline engine depends upon the useful life of the engine in the business. See answer to question No. 105.

Am I entitled to deduct under the heading of "Depreciation" shrinkage in the value of cattle, work horses, and mules purchased or raised on my farm?

Depreciation may be claimed with respect to live stock purchased for breeding or draft purposes on account of reduction in value due to increase of age or other causes.

In 1914 I inherited a farm which I rent. May I claim any amount on account of wear and tear on the buildings which are depreciating in value?

You are entitled to claim a reasonable allowance for depreciation, based on the fair value of the buildings at the time acquired and the estimated life after such acquirement.

Filtration Equipment

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census (p. 28), adopted in 1916, accepted 20 years as the life of filtration equipment.

Flax Spinning and Weaving

The English Inland Revenue allows 7½%, reducing balance method.

Flour Milling

The English Inland Revenue allows 5%, reducing balance method.

Flumes

In the *San Francisco Water Rate Case* (1911), 2.5% was allowed. (Whitten, R. H., I, p. 430.)

Folding Box Manufacturers

See "Label Manufacturers."

Franchises

See "Copyrights."

Furniture and Fixtures

The following is from Nicholson and Rohrbach's *Cost Accounting* (page 151):

	Annual Rate of Depreciation %
Office and Shop Furniture and Fixtures—including store and tool room fixtures:	
Factory equipment	10
Furniture and fixtures	10
Partitions	7½
Watchman's system	7½
Benches, partitions—permanent	7½
Benches	8
Trucks and movable racks	7½
Miscellaneous equipment—including desks, chairs, typewriters, adding and calculating machines, blue-printing machines, filing cabinets and trucks, shelving partitions, time clocks, time detector systems, telephone, flexotypes, graphotypes, etc.	10
Typewriters and adding machines	20
Telephone equipment	7½

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives 15 years as the life of office furniture.

R. H. Montgomery suggests a rate of 15% per annum as a fair average allowance. (*Income Tax Procedure,* 1917, p. 213.)

In January, 1918, the Rulings Board of the Finance Department of the Bureau of Aircraft Production ruled to allow a rate of 10% per annum for depreciation on furniture and fixtures in determining reimbursements to contractors under cost-plus contracts. (*General Ruling No. 4.*)

Gas Plants

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
Engines—gas and oil	7½
Fuel oil system	7½
Oil lines	5
Steel gas-producers, piping, etc.—including gas washers, gas scrubbers, gasometers, dust catchers, and dust collectors	5⅔
Brick gas-producers	6⅔
Gas supply system	6⅔
Gas plant equipment	6⅔

The following is taken from Barker's *Public Utility Rates:*

Gas Works	Life in Years	Authority	Cause
Ammonia concentrators	15	Wisconsin R. R. Comm.	D.
Ammonia storage tanks	15	" " "	D.
Blowers	15	" " "	D.
Coal-gas benches	25	" " "	D.
Exhausters	25	" " "	D.
Gas holders	50	" " "	O. & D.
Governors	50	" " "	D. & O.
Mains:			
Small cast-iron (4 in. and under)	50	" " "	O.
Large cast-iron (6 in. and over)	75	" " "	O.
Small steel or iron (3 in. and under)	20	" " "	D.
Large steel or iron (above 3 in.)	30	" " "	D.
Meter cases (station)	50	" " "	O.
Drums (station)	20	" " "	D.
Meters and governors (consumers)	25	" " "	D.
Purifiers	50	" " "	O.
Scrubbers and condensers	30	" " "	D.
Service pipes	20	" " "	D.
Tar and ammonia wells	50	" " "	O.
Extractor	40	" " "	O.
Water-gas machines	30	" " "	D.

NOTE: D. denotes depreciation. O. denotes obsolescence.

In the *Cedar Rapids Gas Case* (1909), 1.7%, sinking fund method was allowed. (Whitten, R. H., I, p. 428.)

In the *Peoples Gas Light and Coke Company Case* (1911), 2%, sinking fund method was allowed, the composite life of the plant being 35 years and the earning capacity of the fund 4%. (Whitten, R. H., I, p. 429.)

In a New Jersey case 6 cents per 1,000 cubic feet of output was allowed for depreciation. The sinking fund method was criticized as being "not ordinarily applicable in connection with a property where renewals are being made of the minor portions of the plant." (Whitten, R. H., II, p. 1197.) This does not appear to be a vital consideration, however. The fund need not be kept intact. It is realized that a formal fund is not ordinarily practicable, however.

In the *Buffalo Gas Company Case* (1913), the average life of the gas plant was determined to be 35 years. (Whitten, R. H., II, p. 1198.)

In Wisconsin (1912), 2% on reproduction cost new was allowed for depreciation. (Whitten, R. H., II, p. 1203.)

The New York Committee on Statistics and Accounts of Public Utility Companies suggested a tentative depreciation rate on the entire fixed capital of gas companies of 3%.

The English Inland Revenue allows 3%, reducing balance method, on gas holders, and 10% on meters, cookers, and gas fires (private).

Gas Wells

The reader should consult the Treasury income tax regulations, also the *Manual for the Oil and Gas Industry,* issued by the Treasury Department in 1919. See Appendix A.

Glassware

The following rates of depreciation have been adopted by the Illuminating Glassware Guild:

	Annual Rate of Depreciation %
Office equipment	10
Buildings:	
Structural steel	5
Concrete	3
Mill construction	3
Ordinary brick	4
Frame	7
Steam power plant	10
Batch mixers	10
Machinery and equipment	10
Automatic and semi-automatic machinery	12½
Tanks	5
Furnaces	5
Gas producers	10
Automobiles	20

Goodwill

Formerly under the income tax rulings no allowance was permitted for depreciation of goodwill. This was altered by

Treasury Decision 2929, issued October 7, 1919, which was in confirmation of two letters to Levi Cooke, Washington, D. C., one signed by Commissioner Roper and dated June 21, 1919, the other signed by Acting Commissioner J. H. Callan and dated August 19, 1919. Both letters related to obsolescence of goodwill, trade-marks, and trade-brands, the value of which had been impaired or destroyed by prohibition legislation. The following is quoted from the letter dated August 19, 1919:

> In reply you are advised (1) that distillers and dealers in liquors are entitled to make a deduction (based upon actual cost or fair market value as of March 1, 1913) from gross income, on account of depreciation or obsolescence of their intangibles, such as goodwill, trade-marks, trade brands, etc., such deduction being limited to assignable assets, the value of which has been destroyed by prohibition legislation, and (2) that in arriving at the taxable income for the first taxable year ending on or after January 31, 1918, the obsolescence fully accrued on that date is to be allowed as a deduction in computing the income subject to taxation under the Revenue Act of 1918, plus a further deduction of such proportion of the remaining value of the intangible assets as the interval between January 31, 1918, and the end of the taxable year bears to the total interval between January 31, 1918, and January 16, 1920 (unless at an earlier date the taxpayer discontinues his business, in which case such earlier date shall mark the close of the period), and (3) that for any taxable year following the taxable year just referred to a deduction in respect of the value of such intangible assets on January 31, 1918, based upon a ratable distribution will be permissible.
>
> It is the opinion of the department that the ratification of the 18th amendment in the month of January, 1918, by the States of Massachusetts, Maryland, and Kentucky, was the first definite indication that the prohibition amendment would be ratified by the requisite number of State Legislatures, and therefore that on January 31, 1918, a computable portion of the costs of goodwill, trade-marks, trade brands,

> or the value thereof, on March 1, 1913, if acquired prior thereto (excluding any intangibles acquired since that date, the expenditures of which were deductible and had been deducted in computing income for tax purposes) had become obsolescent. On January 31, 1918, the intangible assets had an actual value, viz.: the then present value of the income to be derived therefrom between that date and January 16, 1920, or at an earlier date should the taxpayer discontinue his business prior thereto. This value as stated above should be distributed ratably over the period from January 31, 1918, to January 16, 1920 (unless at an earlier date the taxpayer discontinues his business, in which case such earlier date shall mark the close of the period). The excess of the cost of the intangibles or the value thereof, on March 1, 1913, if acquired prior thereto (subject to the exclusions mentioned above), over the value thereof, as of January 31, 1918, determined as outlined above, will represent the amount of obsolescence that was fully accrued on January 31, 1918.

The existence of goodwill by actual purchase should always be a prerequisite to any consideration of its obsolescence or depreciation, whether for income tax purpose or otherwise. Under the Revenue Act of 1917 the Committee on Appeals and Review recommended that "values claimed for 'contracts, brands, and goodwill' cannot be allowed as invested capital when it is not conclusively shown that such values represent paid-in capital," also that "in reorganization no greater value can be given to corporate assets than existed before reorganization, the interest in the corporation being substantially the same as that in the partnership." (*Committee on Appeals and Review Memorandum* 393.)

In general, accountants have advocated writing down goodwill, presumably on the theory that the purchase price of the goodwill is based on the profits of a number of years less a fair return on the invested capital. Day suggests that interest on the capitalization at 7% per annum should be deducted from the total profits of the past five years to secure the value of the goodwill, and he further states that this amount should be written off over the succeeding five years, 1/5 being charged against each year. Dicksee, on the other hand, says that goodwill does not depreciate, but that it is liable to continual fluctuations in value. The balance sheet figure represents a value somewhere between the extremes.

Since goodwill depends on earning power, its retention in the books after it has been established through a bona fide purchase must depend on earnings. When it appears that earning power has been definitely and permanently curtailed the Goodwill account should be adjusted to correspond with the new conditions. Evidently no rate can be prescribed where fluctuations in value depend on many factors which only the future can determine.

Grading

Grading of railroads may appreciate. (Interstate Commerce Commission *Valuation Docket No. 2,* p. 130 [Texas Midland].) In its valuation of the Texas Midland the Interstate Commerce Commission made no allowance for either appreciation or depreciation. (*Ibid.,* p. 184.)

H. P. Gillette in *Handbook of Cost Data for Contractors and Engineers* (pp. 1317-78), gives 10% as the annual depreciation.

The Controller of Philadelphia in his *Manual of Accounting, Reporting and Business Procedure* gives 1% as the rate of depreciation of filling and terracing.

Hardware Manufacturers

The following rates of depreciation have been adopted by a large association of manufacturers. They apply to the manufacture of general hardware, and were furnished to the author by an official of a large hardware manufacturing company.

Depreciation of buildings and equipment should be estimated at the beginning of each year and one-twelfth of the annual amount should be charged monthly as part of the departmental shop expenses. The following annual depreciation ratios, computed on net or reduced values, are recommended:

	Annual Rate of Depreciation %
Buildings—brick or concrete	3
Buildings—wood	5
Office furniture and fixtures	7
Yard railway	5
Elevators	5
Fire apparatus	3
Piping and plumbing fixtures	3
Electric light equipment	3
Power plant	5
Line shafting	5
Furnaces, ovens, stoves, etc.	5
Shop furniture	10
Shop fixtures	10
Patterns	15
Foundry flasks	15
Machinery	5
Tools, dies, etc.	15

These ratios should be used only where a liberal policy is pursued in the matter of upkeep; that is, where the entire plant is kept always in first class repair, the charges for so keeping it being made to expense accounts 16, 17 and 18, and charged to current expenses and not to betterments.

Horses

E. Matheson, the English authority, advocates a rate of from 20% to 30% on the reducing balance.

The *Uniform Accounts for Systems of Water Supply, Bureau of the Census* (p. 28), gives 10 years as the life of horses.

Horses used in heavy work should be depreciated at about 25% yearly.

F. W. Densham in the *Accountant,* May 28, 1898 (p. 570), suggests either periodic revaluations or a rate of 15% to 25%, according to the severity of work.

A bulletin issued by the United States Department of Agriculture shows that the average depreciation on 27 farms in Illinois, Ohio, and New York is $4.50 per horse.

L. R. Dicksee suggests that the depreciation will vary between 15% and 25% on the starting balance of the account, but thinks that revaluations should be made until enough experience is secured to enable rates to be fixed intelligently.

The Rulings Board of the Finance Division of the Bureau of Aircraft Production in August, 1918, ruled to allow 20% annual depreciation on original cost of horses and mules in arriving at actual cost of manufacture in order to reimburse contractors under cost-plus contracts.

Hotels

R. P. Bolton in *Building for Profit* (p. 76), gives the life of hotels at from 15 to 18 years.

L. R. Dicksee, in *Hotel Accounts,* gives rates of 5-7½-10% on furniture and fixtures.

R. H. Montgomery, in *Auditing Theory and Practice,* suggests periodic revaluations of china, glass, cutlery, silver, etc.; also suggests as an alternative method regular credits to a reserve account and charges to profit and loss of amounts sufficient to cover the estimated actual renewals and depreciation over a period of years, all renewals to be charged to this reserve account.

J. L. Nicholson and J. F. D. Rohrbach, in *Cost Accounting* (p. 146), suggest 5% as the proper rate for hotels.

F. W. Pixley, in *Accountancy* (2nd ed., p. 219), suggests 2½% on furniture, 15% to 25% on carpets, 10% on electro plate, and 2% to 30% on china and glass.

H. S. Tiffany, in *Digest of Depreciations* (p. 7), gives rates of 2½% to 3½% on brick and stone buildings and 3½% to 4½% on frame buildings. These are based on actual life and do not include repairs.

Household Furnishings

R. P. Bolton, in *Building for Profit* (pp. 82-89), gives 16 years as the useful life of sanitary fixtures, refrigerating, piping, kitchen fixtures, and valves.

The Controller of Philadelphia in his *Manual of Accounting, Reporting and Business Procedure* (pp. 207-8), gives 10% as the rate on kitchen, dining-room and household utensils, and crockery.

H. S. Tiffany, in *Digest of Depreciations* (p. 15), gives the following rates:

	Household Furniture %	Furnished Houses %
Carpets	10	20
Furniture	10	20
Crockery and glassware	25	33⅓
Stoves and cutlery	10	20
Beds and bedding	10	20
Pianos	5	10
Mirrors	5	10
Pictures and paintings	5	10
Books	10	20
Family wearing apparel	50	50
Plated ware	10	20

Hydrants

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives 50 years as the life of fire hydrants.

The final report of the committee on depreciation of the American Waterworks Association, *Journal of the American Water Works Association,* September, 1917 (pp. 1-38), places the life of hydrants at from 30 to 50 years.

H. P. Gillette and R. T. Dana in *Handbook of Mechanical and Electrical Cost Data* (p. 108), give 40-50 years as the life of hydrants.

C. E. Grunsky, in *Valuation, Depreciation and the Rate Base* (p. 279), gives 40-50 years.

Authorities agree quite uniformly on 35-50 years.

Hydro-Electric Plant

See data in Chapter V, "Plant Analysis and the Plant Ledger."

Ice Industry

The Commissioner of Internal Revenue has approved the following percentages based on original cost to cover "wear-out depreciation":

	Annual Rate of Depreciation %
For wooden natural ice houses and wooden storehouses....	6 4/10
Ice houses, harvesting and hoisting machinery, including conveyors, hoists, merrimacs, basin saws, etc., and power plants for same, elevators....	9½
Machinery of steam-driven manufacturing plants *....	7 1/10
Machinery of electric-driven manufacturing plants....	7 3/10
Frame buildings	5
Brick buildings	2½
Concrete buildings	2
Horses †	15 4/10
Harness	16 2/10
Wagons and other horse-drawn vehicles	14 3/10
Automobiles	22 5/10
Motor trucks	22 2/10
Sundry delivery equipment	15

* In case of bad water, this figure to be increased up to 7 6/10% as a maximum.

† In case of the Southern States, where a different grade of vehicle and horse is used, these figures become 20% for vehicles.

In applying the above rates the Commissioner recommends that the line of demarcation between maintenance and repairs be drawn:

> Wearout depreciation and maintenance are to be separated according to the definition of wearout depreciation, which is that loss of original usefulness which has gone so far as any "Unit of Utility," beyond the ability of repairs to correct, so as to make necessary the complete replacement of that "Unit." By maintenance (synonymous with repairs) is meant the correction of some local defect of a "Unit of Utility" by bringing the defective portion in the easiest way, into practical parity with the general condition of the remainder of the "Unit." By the definition of a "Unit of

Utility" is meant a single purposed mechanism or part of a construction, subject to such like conditions of use, that it would naturally be repaired or replaced as a unit.

Intangible Property

See "Copyrights," "Goodwill."

Label Manufacturers

The following rates of depreciation have been adopted by the Label Manufacturers National Association, the Folding Box Manufacturers National Association, and the National Association of Employing Lithographers.

	Annual Rate of Depreciation (On Gross Investment Value)
Buildings:	%
Concrete	3–4
Mill construction	4–5
Ordinary brick	5–7
Frame	6–10
Machinery and operating equipment:	
Steam and power plant	5–10
Flat and rotary presses	7½–10
Offset presses	10–12½
Cylinder cutters and creasers	7½–10
Platen cutters and creasers	7½–10
Cutters, straight and die	5
Automatic gluers	7½
Bronzers	12½–15
Bed, platen and cylinder embossers	15
Ink grinders	5
Other ink manufacturing equipment	7½–12½
Electro foundry	7½–10
Electros (originals)—charged to jobs, less scrap value	
Electros (working plates)—charged to jobs, less scrap value	
Litho stones (originals)	2½ up
Litho stones (for presses)	10
Etc. for other machinery and equipment	Various

Laboratory Apparatus and Appliances

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives the life of this as 10 years.

Land

Land ordinarily does not depreciate; yet this is by no means to be regarded as a universal rule. Farm lands suffer actual physical deterioration when their fertility is not maintained by means of constant fertilizing by one means or another.

In case of land utilized for building sites, road-bed, and so on, the situation is somewhat different, since fertility is not a factor of importance. In such cases land tends to appreciate in value due to normal community growth, and the element of wear and tear is immaterial.

In a Massachusetts telephone appraisal for rate purposes, in 1909, land was excluded when calculation of depreciation was made. (Whitten, R. H., I, p. 433.) This is the usual rule in valuation cases. In the *Texas Midland Valuation Case* land which cost originally $67,493.44 was given a present value of $254,479.98. (Interstate Commerce Commission *Valuation Docket No. 2,* p. 77.)

The Bureau of Internal Revenue, for income tax purposes, does not allow for depreciation of improved or unimproved land if it is caused by ordinary erosion, exhaustion, or any other cause. (*Income Tax Primer for Farmers,* 1921, p. 25.)

Frequently land and buildings are indistinguishably merged into a single account. In such cases the two items should be valued separately and thereafter kept in separate accounts. The cost of land includes examination costs, title registration fees, conveyancer's and notary's fees, purchasing agent's commissions or salary, taxes accrued to date of title as well as any liens upon the title when these are assumed by the purchaser. Cost of assessments for public improvements which enhance the value of the land, cost of grading not properly chargeable to building, and expenses of condemnation proceedings may be properly charged to cost of land.

Leaseholds

Leaseholds which terminate at a fixed future date, as well as other assets having a definitely fixed time of expiration must be systematically amortized or written down if capital is to be preserved. These may not depreciate in the strictly material sense of the word, yet the deterioration which takes place is analogous to that which occurs in case of depreciation of other forms of wasting assets. In case of leaseholds, as in case of patents, the period over which the cost must be written off is definitely prescribed.

Leaseholds may be paid for in annual sums, or there may be an initial bonus in addition to the annual sums. Such a bonus should be considered a deferred charge to be distributed over the period covered by the lease.

Leases ordinarily run for any period up to 99 years, but they are sometimes for longer periods. In New York City they are frequently for 63 or 84 years.

When only a periodic rental is paid for the lease no value appears in the books, but when a bonus is paid there appears its unamortized value, which should be written off over the remaining period of the lease by the means of periodic credits to the leasehold and corresponding charges to Rent account.

Licenses

See "Copyrights."

Lithographers

See "Label Manufacturers."

Lumber

H. S. Tiffany in his *Digest of Depreciations* (p. 16), gives the following rates for different kinds of lumber:

	Annual Rate of Depreciation %
Ash	10
Hickory	15
Sycamore	25
Beech	12
Poplar	8
Oak (burr and white)	6
Oak (red and black)	12
Cotton wood	12
Walnut	8
Hard maple	6
Soft maple	8
Linn	12
Pine (white or yellow)	5

Machinery

See "Miscellaneous."

The following is from McKay's *Valuing Industrial Properties:*

	Life in Years	Authority
Air brakes	20	Henry Floy
Air compressors	20–25	"
Boring mills	28	C. W. McKay
Bench tools (bench lathes, presses, etc.)	15	"
Boring bars and drills (depending upon size, type, and use)	1– 5	"
Belting	12–13	Henry Floy
Boilers	25–33	B. J. Arnold
Boilers	12–16	H. P. Gillette
Boilers (water tube)	20	Henry Floy
Bonds	20	"
Breechings and connections	10–33	"
Chucks (depending upon size, type and use)	5–10	C. W. McKay
Coal and ash-handling machinery	14	Henry Floy
Condensers	10–25	"
Electrical machinery	20–30	H. P. Gillette
Engine lathes	25	C. W. McKay
Engines, steam	15–25	H. P. Gillette
Engines, steam	13⅓–33⅓	B. J. Arnold
Engines, steam	20	Henry Floy
Electric light plants, boilers	20	Wm. Arthur
Electric power plants, boiler plant	12	"
Electric power plant, engines and dynamos	20	"
Electric light plant, engines and dynamos	12	"
Feeders (W. P. insulation)	16	Henry Floy
Foundation (machinery)	*	"
Fuel oil handling machinery	25	"

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* Same as life of apparatus supported.

	Life in Years	Authority
Gates	40–50	H. P. Gillette
Gas engines	15–20	Henry Floy
Generators	12⅓–33⅓	"
Heaters (water)	16⅔–30	"
Jigs, fixtures	3–10	C. W. McKay
Large drill press	20	"
Meters, electric	20–30	H. P. Gillette
Meters, electric	12½–20	Henry Floy
Motors and electric equipment	20	C. W. McKay
Motors, railway	3⅓–10	Henry Floy
Planers	20	C. W. McKay
Pumps	16–20	Henry Floy
Pumping and auxiliary machinery	20–30	H. P. Gillette
Pumping machinery	20	Wm. Arthur
Reamers	20	C. W. McKay
Railroad machinery	20	Wm. Arthur
Railroad tools	1⅓	"
Railroad telegraph instruments (salvage value 15%)	12–25	"
Railroad telephone instruments (salvage value 8% new)	12–25	"
Railroad interlocking and other signal apparatus	20	"
Railroad section men's tools (average)	8	"
Small lathes	18	C. W. McKay
Small drill presses	18	"
Shapers	18	"
Shafting, pulleys and countershafts	5–10	"
Stokers (fixed parts)	5	Henry Floy
Stokers (moving parts)	20	"
Storage batteries	5– 6⅔	"
Steam locomotives, including tanks (salvage value 5½%)	25	Wm. Arthur
Shop tools and machinery	10	H. P. Gillette
Transformers	16–20	Henry Floy
Turbines (steam and water)	16–30	"

The following is from Ficker's *Industrial Cost Finding:*

	Annual Rate of Depreciation %
Machinery and large equipment:	
Boilers, pumps, feedwater, heaters and air compressors	6
Power piping	6
Switchboards, main wiring and conduit	6
Engines and dynamos	5
Machinery, motors, machine tools, traveling cranes, etc.	4.5
Punch presses, bending rolls, power shears and drop hammers	4.5
Machine tool accessories—boring bars, drivers, key seating broaches, etc. (all renewals to repairs)	50

	Annual Rate of Depreciation %
Machinery and large equipment (*Continued*):	
Cupolas, converters, melting furnaces, and accessories	5
Annealing and heating furnaces, ovens, forges, etc.	5
Motor trucks	20
Storage battery locomotives (battery renewals to repairs)	10
Horses and wagons	12
Small tools:	
For machines, net additions	50
Hand tools, net additions	50
Punches and dies (standard), net additions	50
Chills, iron and steel flasks and accessories, net additions	50

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
MACHINERY:	
Machine tools:	
Lathes, slotters, planers, drilling and boring machines; milling machines, tools and surface grinders; emery wheels, keyway cutters, tapping machines, arbor presses, centering machines, squaring machines, hack saws, notching machines, buffing machines, test pumps, pointing machines, metal band saws, belt lacers, saw grinders, etc.; die sinking machines, car wheel presses, saw-setting and filing machines, angle-benching machines, cold saw-cutting off machines, etc.	6⅔
Gun and tool machinery	6
Cartridge machinery	8
Tool and shop machinery	5
Punches, shears, hydraulic and pneumatic riveters; bending rolls, straightening rolls, straightening presses, bulldozers, joggling machines, flanging machines, frame-setting machines, beveling machines, keel-bending machines, can brakes, etc., forging and upsetting machines	6⅔
Punch presses, bending rolls, power shears and drop hammers	6⅔
Hydraulic forging presses, bending presses and fluid compressors	6⅔
Hammers—steam, drop or helve	10
Shafting, pulleys, hangers and belting	5
Belting	7
Wood-working machinery—including band, jig and rip saws, dove-tailing machines, moulding machines, tenoners, mortisers, sizers, wood-boring machines, wood shapers, wood lathes, wood planers, universal wood workers, carvers and moulders, sanding machines, surfacers, swing saws, scroll saws, jointers and wood cut-off saws, embossing press, core box, disc grinders	5

	Annual Rate of Depreciation %
Miscellaneous machinery:	
Locomotive cranes, steam and electric shovels	10
Coal and ash-handling machinery	8
Hydraulic jacks	10
Conveyors—coal, ash and sand, screw conveyors	6
Skip and stock hoists	6
Grinding and mixing machines; crushers, pulverizers, squeezers, scrap shears, concrete mixers, mud guns, jarring machines, tumbling barrels, water cinder mills, sand blast machinery, moulding machines, core-ramming machines, roller feeders, etc.; testing machines, vibrating machines, tie rod machines, welding machines, etc.; magnetic separators, venturimeters, oil meters, fans, gauges, blowers, shaving exhaust system, acetylene generators, oil-testing machines, sand dryers, oiling systems, sewing machines, locking machines, crimping machines, classifiers, thickeners, ball mills, roller feeders, revolving screens, flotation machines, belt-strapping machines, mechanical mixing machines, etc.	10
Pickling washing machines, electric and acetylene welding machines	10
Small Tools:	
All small tools of an asset nature	10

The following is from Kimbal's *Cost Finding:*

	Life in Years
Steam engines	15–30
Steam boilers	15–30
Boiler room feed pumps	20
Engine-room instruments and gauges	10
Steam piping, valves and fittings	10–15
Portable engines and boilers	10
Gas engines	10–15
Turbo generators	20–30
Electric generators	20–30
Electric motors	20
Storage batteries	10
Switchboards and instruments	15
Heavy machine tools	25
Light machine tools	15–20
Shafting, hangers and pulleys	20–30
Belting	10–25

When the rate on loose plant and tools would exceed 20% per annum it is better not to write off an annual percentage. One alternative is to make a rough valuation each year by count or otherwise; another is to charge all costs of maintenance and renewal to income. It may be found desirable to classify this type of assets into groups for accounting purposes.

In the *Chicago Union Traction Case* (1902), 6% was allowed, to determine net earnings. (Whitten, R. H., I, p. 424.)

In the Texas Midland valuation the service condition of small hand-tools and other similar property was generally assumed to be 50%. The service condition of machinery and equipment was determined by actual observation, taking into consideration its age and its expected service life. (Interstate Commerce Commission *Valuation Docket No. 2,* p. 86.)

The English Inland Revenue allows 15%, reducing balance method, on machinery used in steel manufacture.

The General Electric Company carries a reserve of $21,695,883.32 against a book figure for machinery of $49,262,663.81. (*Twenty-ninth Annual Report,* p. 6.)

The Rulings Board of the Finance Department of the Bureau of Aircraft Production, in January, 1918, ruled to allow 7½% per annum on machinery in determining contractors' reimbursements under cost-plus contracts. (*General Ruling No. 4.*)

Malleable Iron Industry

The American Malleable Castings Association, out of the experience of its members, approves the following rates for the principal kinds of malleable iron foundry buildings and equipment.

	Annual Rate of Depreciation %
Buildings:	
Concrete	2½
Brick	3
Sheet iron	10
Melting department equipment:	
Melting furnaces and apparatus	7½
Spruce mill and slag washer	15
Laboratory equipment	10
Crane	10

	Annual Rate of Depreciation %
Molding department equipment:	
Hand squeezers	15
Air molding machines	20
Core department equipment:	
Core ovens and apparatus	7½
Core machines	15
Sand mixer	20
Benches, racks, trays, trucks	10
Hard iron cleaning department equipment:	
Tumbling barrels, with motor, shafting and belting	15
Sand blast barrels and tables, motor shafting and belting	30
Dust arrester	10
Finishing department equipment:	
Emery wheel stands, drop hammers, lathes, drill presses, air choppers, milling machines, threshing machines, etc., with motor, shafting and belting	10
Assorting and shipping department equipment:	
Sorting tables, trucks, scales, etc.	10
Automobile trucks	20
Trimming and inspecting department equipment:	
Benches, scales, trucks	10
Emery wheel stands, with motor, shafting and belting	10
Annealing department equipment:	
Annealing ovens and apparatus	10
Annealing trucks	20
Crane	10
Soft iron cleaning department equipment:	
Tumbling barrels, with motor, shafting and belting	15
Sand blast barrels and tables, motor shafting and belting	30
Dust arrester	10
Power plant equipment:	
Steam boiler, generator, air compressor, steam piping, electric wiring, etc.	7½
Office furniture and fixtures	10

Experience has proved these rates to be conservative, and it is very doubtful if the member who is not providing for depreciation at substantially the rates noted above is fully maintaining his plant values.

The amount provided to represent the deterioration in plant and equipment values due to wear and tear and obsolescence should be charged monthly to cost of production and credited to Buildings and Equipment Depreciation Reserve accounts. Against the reserve accounts should be charged all expenditures of the nature of complete renewals and replacements which to that extent restore plant values and reduce the accrued depreciation.

Current repairs and partial renewals of an inextensive nature should be charged directly to cost of production.

Masonry

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives 50 years as the life of masonry of filtration plants.

In the Texas Midland valuation 100 years was taken as the normal life of concrete and other masonry. (*Interstate Commerce Commission Valuation Docket No. 2,* p. 184.)

Mine Equipment

In a synopsis of a report made by the committee on cost of the Winding Gulf Association, published in *Coal Age,* September 19, 1918 (pp. 545-7), the following rates of depreciation based on original cost were recommended:

	Annual Rate of Depreciation %
Structures:	
Wooden tipples, complete	8
Steel tipples, complete	5
Wooden power house (building)	7
Stone or brick power house	5
Machine shop—wood	8
Machine shop—stone or brick	5
Supply house—wood	8
" " —stone or brick	5
Blacksmith shop—wood	8
" " —stone or brick	5
Stable building—wood	8
" " —stone or brick	5
Churches and schools	4
Squire's office and jail	4
Sand houses	4
Post office building	4
Substation—wood	7
" —stone or brick	5
Humidifier building—wood	7
" " —stone or brick	5
Powder house—concrete, stone or brick	10
Wash house—wood	10
" " —stone or brick	5
Fireproof vaults	4
Freight stations	10
All other small buildings	10
Mine development:	
Clearing property	5
Creek changes	5
Wagon roads	5

	Annual Rate of Depreciation %
Slopes and shafts	5
Diamond and drill holes	5
Train roads	20
Mine development	10
Equipment:	
Dynamos and engines	8
Boilers	11
Pumps, heaters, and other power house equipment	8
Header lines	8
Fans	5
Water tanks	7
Railway sidings and approaches	7
Humidifiers	12½
Telephone lines	10
Saw mills	10
Hoists	7
Incline drums and larries	10
Incline ropes	33⅓
Cage ropes	50
Hoist engines	7
Mine telephones	20
Mine pumps	20
Steel rail	10
Mine wagons (cars) wood	20
“ “ “ steel	17
Mine locomotives	10
Mining machinery	20
Electric drills	20
Stable equipment	25
Patent mine doors	20
Copper wire	7
Supply house fixtures	10
Post office equipment and fixtures	7
Fire equipment	20
Air compressors	8
Good roads machinery	10
Shop fixtures and machinery	7
Stationary motors	7
Watchmen's clocks	10
Pipe lines in mines	33⅓
Barber shop fixtures and barber shop	10
Miscellaneous building and fixtures:	
Theater building	6
Theater building fixtures	6
“ “ and poolroom	20
Store and office buildings—wood	6
“ “ “ “ —stone or brick	5
Furniture and fixtures in same	10
Tenement houses	6
Club house furniture	15

Miscellaneous

The following is from McKay's *Valuing Industrial Properties:*

	Life in Years	Authority
Arc lamps	15	Henry Floy
Box drains	16	H. P. Gillette
Bolts and nut locks	20	Wm. Arthur
Brick platforms and walks	33	“
Bridges:		
Steel	50	“
Concrete and stone	50	“
Wood	8–28	“
Cinders and sand for ballast	6½	“
Cast iron pipe of large diameter	50–75	H. P. Gillette
Cast iron pipe of small diameter	20–40	“
Cribbing and bulk heading	10	“
Cement platform and walks	33	Wm. Arthur
Concrete curbing	20	“
Curbings, wood	20	“
Cinder and gravel platforms and walks with no curbing	22	“
Cinder and gravel platforms and walks with wooden curbing	12	“
Coach and chair cars (salvage value 6% new)	25	“
Cables:		
Cables, underground (low tension) (50% of maintenance cost)		Henry Floy
Cables, aërial (telephone)	15	C. W. McKay
Aërial cable (lead covered)	15	Wm. Arthur
Underground (lead covered)	20–25	“
Conduits	100	Henry Floy
Conduits	50	C. W. McKay
Cross arms	8–12	Henry Floy
Culverts:		
Wooden box	10	Wm. Arthur
Cast iron pipe	50	“
Vitrified pipe	20	“
Cement pipe	50	“
Concrete and stone	50	“
Crushed stone and granite ballast	50	“
Docks and wharves	33	H. P. Gillette
Electric light plants, incidental apparatus	12	Wm. Arthur
Electric power plants, incidental apparatus	12	“
Fencing:		
Wooden entirely	15	“
Wooden posts, wire panels	20	“
Cement and iron posts, wire panels	22	“
Fences	14	H. P. Gillette
Frogs—Railroad track	32	Wm. Arthur
Gravel and burned clay ballast (Nebraska and similar products)	20	“

	Life in Years	Authority
Hand cars	14	Wm. Arthur
Hydrants	40–50	H. P. Gillette
Howe truss bridges	10	“
Poles and attachments for electric transmission	20	Wm. Arthur
Paving	2	Henry Floy
Paving	2	C. W. McKay
Piping covering	22–25	Henry Floy
Poles:		
Steel	50	“
Wood in concrete	20	“
Wood in earth	12–18	“
Iron	40	“
Wooden	10	Wm. Arthur
Rail	4–10	
Reservoirs	50–100	H. P. Gillette
Rails, track fastenings, etc.	40	“
Rolling stock:		
Open car bodies	25	Henry Floy
Open trailer bodies	25	“
Closed car bodies	20	“
Trucks	20–28	“
Passenger cars (express, baggage, and mail—salvage value 8%)	25	Wm. Arthur
Freight cars	18	“
Shop furniture	10	C. W. McKay
Stand pipes	50–100	H. P. Gillette
Steel pipe	25–50	“
Switchboard and wiring	16¼–33⅓	Henry Floy
Spikes	12	Wm. Arthur
Split joints and attachments	19	“
Tunnels (all kinds)	20–50	“
Telephone and telegraph poles and pole attachments	20	“
Telephones	10	Henry Floy
Ties for new track:		
Oak (white)	12	Wm. Arthur
Oak (mixed)	7	“
Fir and pine	6	“
Cedar	12	“
Tamarac	8	“
Hemlock	6	“
Cypress	6	“
Water tanks:		
Wooden	20	“
Steel, including water softeners	33⅓	“
Galvanized iron	10	“
Wind mills	8	“
Wire for telephone and telegraph	25	“
Wire, electric transmission	20	“
Wood stave pipe	25–30	H. P. Gillette
Wrought iron service pipe	15–30	“
Wood sidewalks	12	Wm. Arthur

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
Miscellaneous shop equipment:	
Anvils, forges, bending blocks, surface plates, mandrels, porter bars, extractors, track and wagon scales, crane scales, portable scales, oil and powder cans, oil filters, glue pots, barrels, microscopes, pyrometers, calorimeters, storage batteries, air hose	10
Picking tanks, etc.	20
Testing apparatus	10
Testing instruments (electric)	10
Fixed kettles and scales	10
Laboratory and scientific apparatus	10
Restaurant equipment	10
Surgical instruments	10
Yard equipment	7½
Floating equipment	10
Patterns—Standard:	
Metal, net additions	75
Wood, net additions	100

In August, 1918, the Rulings Board of the Finance Division of the Bureau of Aircraft Production, in determining rates of depreciation for construction equipment used in constructing acetone plants, ruled that:

> Depreciation on construction equipment either rented or owned shall be allowed as actual cost in accordance with the following schedule, unless the contract specifically provides otherwise:

	Depreciation per Day
Adding and listing machines	$ .20
Buckets, tipple and pottom dump	.25
Boring machine, pneumatic	.50
Boring machine, electric	.50
Buckets, orangepeel, 1 yard	3.50
Buckets, orangepeel, less than 1 yard	2.00
Buckets, clandell	2.00
Boiler, and 3 drum engine	3.50
Boiler, and 2 drum engine	3.00
Boiler, and 1 drum engine	2.50
Boiler only, 30 h.p. and smaller	1.50
Boiler only, larger than 30 h.p.	2.00

	Depreciation per Day
Block machine, concrete	$ 1.50
Cars, skip, 1½ yards	.25
Cars, skip, 3 yards	.50
Cars, steel, 1 yard and smaller	.15
Cars, 4 yards, wooden	.25
Cars, 6 yards, wooden	.75
Cars, 12 yards, wooden	2.00
Cars, 1 yard, hopper, radial gate	.25
Crushers only	2.00
Crushers with elevator and screen	3.00
Conveyor, gravity, per 100 feet	1.00
Compressor, 10x10, with steam engine	2.50
Compressor, 8x8, belt driven	1.00
Compressor, with gasoline engine on wheels	5.00
Compressor, Westinghouse, 9½ inch	1.00
Cableways, without engine	4.00
Drill, auto traction	5.00
Dump wagons	.25
Driving outfit with pumps	10.00
Derricks, 60 feet to 85 feet	2.00
Derricks, 30 feet to 59 feet	1.50
Derricks, less than 30 feet	1.00
Derricks, breast	.25
Derricks, circle swing	.25
Elevators, platform or bucket	.25
Elevators, with bins for concrete	.50
Engines, skeleton, 3 drum	2.00
Engines, skeleton, 2 drum	1.50
Engines, skeleton, 1 drum	1.00
Engines, steam, horizontal, 11 to 40 h.p.	1.50
Engines, steam, upright, to 10 h.p.	.50
Engines, gasoline, to 8 h.p.	.50
Engines, 2 drum, with electric motor	4.00
Engines, gasoline, 10 h.p.	1.00
Engines, derricks, swinging	.50
Hammers, riveting	.25
Hod elevating machine	1.00
Levelling instruments, engineers'	.25
Locomotive, 36-inch gauge	5.00
Locomotive, standard gauge	10.00
Mixers with boiler and sideloader	4.00
Mixers with electric motors, 1 yard	4.00
Mixers without boiler, less than 1 yard	2.00
Mixers without boiler, 1 yard and larger	3.50
Mixers with gasoline engine	3.00
Motorcycles	1.00
Motors, 2 h.p.	.15
Motors, 5 h.p.	.25
Motors, 10 h.p.	.50
Motors, 25 h.p.	1.00
Motors, 50 h.p.	2.00
Pumps, centrifugal, 10 inch, belt driven	3.00

	Depreciation per Day
Pumps, centrifugal, 10 inch, with motor attached	$ 4.00
Pumps, centrifugal, 8 inch, steam connected	2.00
Pumps, centrifugal, 6 inch, steam connected	1.50
Pumps, centrifugal, 4 inch, steam connected	1.00
Pumps, duplex and triplex to 3 inch	.50
Pumps, pulsometer to 4 inch	1.55
Pumps, diaphragm	.20
Pumps, diaphragm with gas engine	1.05
Pumps, triplex with belt drive	.20
Pile drivers, drop	1.50
Pile drivers, drop with single drum engine and boiler	3.50
Pile hammers, steam, up to 2,500 lbs.	3.00
Pile hammers, steam, larger than 2,500 lbs.	5.00
Rail, per ton	.06
Roller, horse	1.00
Steam drills	1.00
Small air drills	.50
Steam roller	8.00
Steam shovel, large	30.00
Sprinkling cart	1.00
Saw benches	.25
Saw benches with motor or gasoline engine	.50
Scale boxes	.25
Scraper, wheel	.50
Transits	.50
Typewriter	.10

Oil and Gas Well Equipment

See Appendix A.

Paper Mills

The English Inland Revenue permits as maximum rates, 5% reducing balance method for machinery working during the day only, and 7½% for machinery working both night and day.

R. H. Montgomery in his *Auditing, Theory and Practice* ([1916], p. 418), says that buildings should be depreciated at a very low rate, and equipment at from 3% to 5%. In his *Income Tax Procedure,* 1919 (p. 571), he suggests 7½% for machinery running night and day.

The Federal Trade Commission has found that several of our best managed mills allow 5% on their investment, which figure the Commission has adopted as adequate.

H. S. Tiffany in his *Digest of Depreciations* gives 2½% for brick buildings and 3½% for frame buildings.

Patents

See also "Copyrights."

The following table gives terms of patents and of trade-marks in leading countries:

Country	Term of Patent	Term of Trade-Mark
Great Britain	16 years; extended from 14 years by act of Parliament, 1919	14 years renewable
France	5, 10, or 15 years from filing of application	15 years renewable
Germany	15 years from next day after filing	10 years renewable
Russia	15 years	1 to 10 years
Canada	18 years	General unlimited; special 25 years renewable
Australia	14 years	14 years renewable
Austria	15 years	10 years renewable
Switzerland	10 years for chemical process 15 years from filing	20 years renewable
Sweden	15 years from filing	10 years renewable
Denmark	15 years	10 years renewable
United States	17 years	20 years renewable

> The duration of patent rights in Great Britain was extended from 14 to 16 years in 1919 (see 9, and 9 and 10, Geo. V, c. 80 Chitty, *Annual Statutes,* 1919, p. 423). No corresponding change seems to have been made with respect to trade-marks. Important patent legislation is now pending in France which will radically change the existing law if passed.
>
> The only actual change in duration of patents and trade-marks since 1909 in the countries named seems to have been in Great Britain, as indicated above. (*Office Decision* 721, Bureau of Internal Revenue.)

Patterns

L. R. Dicksee suggests a rate of from 25% to 33 1/3% for patterns. E. Guthrie suggests 50% the first year, 30%

the second, and 20% the third year for designs, and 20% to 30%, reducing balance method, for patterns. R. H. Montgomery says the depreciation charge should usually equal the annual expenditure for new patterns, and that wherever possible the total book value should be written down to $1. (*Income Tax Procedure,* 1919, p. 573-75, Supp. 1142-43.) This policy is pursued by the General Electric Company which carries patterns which cost nearly $2,000,000 at a net book valuation of $1. C. Piez suggests a rate of 75% on new additions to metal patterns and a rate of 100% on new additions to wood patterns. J. L. Nicholson and J. F. D. Rohrbach, in *Cost Accounting* (p. 151), suggest the same rates. C. E. Woods suggests a rate of from 33 1/3% to 100% per annum. (*Unified Accounting Methods for Industrials,* p. 65.)

In general, when patterns are made for a specific order they should be charged wholly to that order, but when they are made for a stock product their future value depends on various considerations.

Pipe

CAST IRON.—In *Spring Valley Water Works v. San Francisco* (192 Fed. 137, decided October 31, 1911), the district judge found the depreciation of cast iron pipes to be 1% per annum. (Whitten, R. H., I, p. 430.)

SERVICE.—The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives the life of service pipe as 15 years.

STEAM.—The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives 20 years as the life of steam pipes.

WOOD.—The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives the life of wood pipe as 25 years.

WROUGHT IRON.—In *Spring Valley Water Works v. San*

Francisco (192 Fed. 137, decided October 21, 1911), the district judge found the annual depreciation of wrought iron pipes to be 2%. (Whitten, R. H., I, p. 430.)

The *Uniform Accounts for Systems of Water Supply,* Bureau of the Census, gives 50 years as the life of iron water pipes.

For much additional data on depreciation of pipes see *Accountants' Index,* 1920, pp. 546-554.

Power Plant

Foster in his *Engineering Valuation of Public Utilities and Factories* (pp. 200, 205), gives the following for power plant and substation equipment:

	Annual Rate of Depreciation %
Engines, boilers, heaters, conveyors, pumps and auxiliaries	4.5
Rotaries, transformers, switchboards, auxiliaries	4.5
Storage batteries	3.0
Turbines and generators	6.0

R. H. Montgomery suggests a rate of 8% for power plant equipment, based on gross book values at the end of the preceding year. (*Income Tax Procedure,* 1919, p. 563; also 1920, p. 716.)

M. E. Cooley gave a life of 12½ years to power plant equipment in the *Milwaukee 3-Cent Fare Case.* In the same case M. G. Starrett gave 20 years as the life of equipment. (*Report of Wisconsin Railroad Commission,* X, p. 226.) The Commission accepted 21.01 years.

C. E. Woods gives 10% per annum for power plant. (*Unified Accounting Methods for Industrials,* p. 65.)

Printing

The United Typothetae of America in their *Treatise on the Standard Accounting System for Printers* (p. 40), give:

	Annual Rate of Depreciation %
Type	25
Hand composition fixtures	10
Machines	10
Machine composition metal:	
Linotype	2
Monotype	3

The manager of the Philadelphia printers' Board of Trade says that progressive printers regard depreciation in the composition room as not less than 20%, and of machinery, stands, furniture, etc., 10%. However, many printers make a flat rate depreciation charge of not over 10%, and some go as low as 5%.

The English Inland Revenue permits the following maximum rates on the reducing balance:

	Annual Rate of Depreciation %
Engines, boilers, and shafting	5
Printing and binding machines	7½
Type	10

Public Utility Companies

See "Electric Plants," "Gas Plants," and "Water Works."

Many states now have laws making depreciation reserves compulsory on the part of utility companies. The following quotation from the report of the New York Committee on Accounts and Statistics of Public Utility Companies indicates the tendencies:

> It thus appears that in 15 states there are special enactments requiring the utilities to maintain depreciation reserves or conferring authority upon the supervisory body to make such requirement. Seven additional states have exercised such authority as a matter of accounting just as the Interstate Commerce Commission has done, without any other or further authority than to regulate accounting procedure. These 22 states embrace most of those that supervise the

> purely local utilities like gas, electric and water companies. In 16 other states telephone and electric railway companies are subject to the requirement, either under federal or state regulations, while only 9 states (besides Delaware and Utah, which have no state commissions) have not taken action so far as the Committee has information, namely, Connecticut, Georgia, Kansas, Nevada, North Carolina, Oklahoma, Vermont, West Virginia and Wyoming. Certain of these states have no authority to regulate accounting practices; others report that accounting classifications are in course of preparation.
>
> . . . .
>
> In most cases the statutes go beyond the mere requirement of a depreciation account in that they confer power on the commission to fix the rates of depreciation and require the companies to expend the moneys reserved for depreciation under regulations prescribed by the commission.
>
> A review of the action taken by the commissions under these statutes indicates that they are proceeding with caution in establishing rates, and regulations as to the use of depreciation funds. In nearly every state orders have been issued only after thorough investigation in individual cases involving the determination of rates or the approval of security issues. Both the straight-line method and the sinking-fund method of computing depreciation are used,—the former in nearly all cases in which reproduction-cost or "value of property" is used as the rate-base and the latter in many cases in which investment is taken as the rate-base.

The following quotation from the laws of New Jersey is typical of state legislation of the compulsory type:

> Sec. 17. The board shall have power, after hearing, upon notice by order in writing to require every public utility as herein defined: (f) To carry, whenever in the judgment of the board it may reasonably be required, for the protection of stockholders, bondholders or creditors, a proper and adequate depreciation account in accordance with such rules, regulations and forms of account as the board may prescribe. The board shall from time to time ascertain and determine,

and by order in writing after hearing, fix proper and adequate rates of depreciation of the property of each public utility, in accordance with such regulations or classifications, which rates shall be sufficient to provide the amounts required over and above the expense of maintenance to keep such property in a state of efficiency corresponding to the progress of the industry. Each public utility shall conform its depreciation accounts to the rates so ascertained, determined and fixed, and shall set aside the moneys so provided for out of earnings and carry the same in a depreciation fund. The income from investments of moneys shall not be extended (sic) otherwise than for depreciation, improvements, new constructions, extensions or additions to the property of such public utility.

Radium

The Treasury Department has ruled as follows:

> Since the full life of radium has been scientifically estimated at such an extended period and since no appreciable depreciation results from its continued use as a therapeutic agent, the depreciation occurring during the lifetime of any individual owner is practically negligible. It is held, therefore, that radium which is used as a therapeutic agent is not subject to depreciation for income tax purposes and its cost must be treated as a capital expenditure. The return of capital will be realized upon its sale or other disposition. (*Office Decision* 837, 10-21-1496.)

Railroads

See Appendix B. The following is from Barker's *Public Utility Rates:*

RAILWAYS	Life in Years	Authority	Cause
Bridges:			
Steel	20–50	Barker	O.
Wood	10	"	D.
Buildings:			
Office, masonry	70	"	O.
Dwelling, etc., wood-frame	30	"	O. or D.

Railways	Life in Years	Authority	Cause
Stations, masonry	40	Barker	O.
Wood	20	"	O.
Shops, first class	75	Wisconsin R. R. Comm.	O.
Second class	50	" " "	D.
Sheds, wood-frame	20	Barker	D.
Cars:			
Freight, wood	10–20	"	D.
Steel	15–30	"	D.
Passenger, wood	20–25	"	O.
Steel	25–30	"	D.
Dining, parlor and sleeping, wood	15–20	"	O.
Steel	20–25	"	O.
Locomotives:			
Freight	15–20	"	D.
Passenger	15–20	"	D.
Switching	20	"	D.
Signals	30	"	O.
Track:			
Rail, main-line tangent.	2– 8	"	D. & O.
Main-line curve	1– 5	"	D. & O.
Sidings and yards	10–20	"	D.
Ties, ordinary light wood	5–10	"	D.
Ordinary hardwood	10–15	"	D.
Treated and protected..	30	"	D.

NOTE: O denotes obsolescence. D. denotes depreciation.

The following rates are given by H. L. Gray in *Railway Age Gazette,* May 27, 1910 (pp. 1297-98, 1290), July 8, 1910 (p. 66).

A fair average allowance for depreciation would be:

	Per Cent
Of the cost of property subject to depreciation	5½
" " " " " on electric roads	6½
" " " " " on street railways	5

The following table is used for the state of Washington:

	Annual Rate of Depreciation %
Ballast	8
Ties	15
Rails (main track)	3
Fastenings	5

	Annual Rate of Depreciation %
Frogs and switches	7
Plank paving	8
Track laying	5
Timber tunnel lining	8
Combination bridges	6
Howe truss bridges	9
Pile and frame bridges	10
Wooden culverts	10
Crossings and signs	8
Fences and cattle-guards	8
Telephone and telegraph instruments	6
Poles and fixtures	8
Covered copper feeder	2
Trolley wire	5
Rail bonds	3
Brick buildings	2
Frame buildings	3
Shop machinery	6
Water and fuel stations	4
Roadway tools	10
Interlocking and signal apparatus	7
Substation apparatus	5
Furniture and fixtures	3
Storage batteries	15
Passenger cars (steam)	3
Passenger cars (electric)	5
Freight cars (steam)	4
Freight cars (electric)	4
Steam locomotives	3
Electric equipment of cars	5

In the Texas Midland valuation the life of rails was taken as 40 years. (Interstate Commerce Commission *Valuation Docket No. 2,* p. 52.)

> A study of the rail of the Texas Midland Railroad led to the conclusion that any rail in main-line track could be expected to have a total life of 40 years as new rail before becoming relay; that new rail laid in side tracks could be expected to have a life of 100 years before coming scrap; and that relay rail would have a life of 60 years before becoming scrap. (*Ibid.,* pp. 82-83.)

The following is quoted from *Bulletin of the Investment Bankers Association of America:*

> Depreciation of Equipment—The figures furnished by different roads as to the amount charged for depreciation of equipment show a wide variation, and in a great majority of cases, in our opinion, grossly inadequate. We are taking steps that we hope will result in improving this condition. (Vol. IV, p. 96.)
>
> Or again, *accrued depreciation,* which is provided for out of operating expenses, is an accumulative fund of which perhaps 90% is set aside for equipment. But suppose a road with $60,000,000 of equipment on the rails, $20,000,000 of equipment trusts outstanding, and accrued depreciation of $30,000,000,—there is no way at present of ascertaining whether the $30,000,000 has been applied only to the unpledged cars or not, or what specific sum, if any, has been set aside for any particular series of rolling stock in which the banker may have had a selling interest. (Vol. II, No. 4, p. 38.)
>
> The private banking firms handling Equipments all insisted that some provision should be made to provide greater safety for the investor in this class of Security. During the last year a number of situations have come to notice where, when a road has got into financial difficulties, we have found that the equipment pledged under Equipment Trusts has become so depreciated in value as to seriously impair the Security of the Equipment Trust issued against it. When cars were lost or destroyed new equipment has not been added. New equipment has been bought through the issue of new Equipment Trusts instead of money being spent in keeping equipment already owned in proper repair, a more favorable statement of net earnings resulting thereby. Even in an extreme case the actual maturing obligations have been bought in by the Railroad and kept alive instead of being retired and paid off. The fundamental theory of an Equipment Trust by which the paying off of a portion of the Trust each year should take care of the depreciation of said equipment and the Security of the Trust maintained, has been thus violated.

The above show that for at least one very important class of railroad assets depreciation reserves are not useless.

Reservoirs

Most authorities give the life of reservoirs as ranging from 50 to 100 years.

The *Uniform System of Accounts for Systems of Water Supply,* Bureau of the Census, gives the life of reservoirs, tunnels, and aqueducts as 100 years.

Leonard Metcalf gives 50 to 100 years; C. B. Burdick, 100 years; the California Railroad Commission, 100 years.

Retail Trade

Ordinarily stock on hand is not supposed to depreciate; yet while no formal allowance for depreciation thereon is permitted by the Bureau of Internal Revenue, there is a material shrinkage in inventory values which is reflected in the current income account as the result of price reductions made in order to enable merchants to dispose of merchandise which has become shopworn.

R. H. Montgomery gives the shrinkages for retail and department stores in *Auditing Theory and Practice,* 1916 (p. 622), as follows:

	Annual Rate of Depreciation and Shrinkage %
Jewelry	.95
Retail clothing	1.16
Drugs	.47
Department store	1.61
Furniture	2.14
Mail order	.12
Shoes	.50
Vehicles and implements	.62
Dry goods	1.11
Hardware	.52
Variety	.06
Grocery	.76

H. S. Tiffany in his *Digest of Depreciations* (pp. 13, 16, 17), gives the following:

	Annual Rate of Depreciation %
Dry goods	12½
Wholesale	12½
Retail	25
Wooden and willow ware	10
Queensware	5

also the following (at page 18) for stocks in retail stores:

	Annual Rate of Depreciation %
Boots and shoes—Depreciate annually	15
Clothing—Depreciates first year	20
Clothing—Depreciates second year	30
Dry goods—Depreciate annually	15
Groceries—Depreciate annually	10
Hardware—Depreciates annually	15
Hats and caps—Depreciate annually	20
Laces—Depreciate annually	25
Notions—Depreciate annually	25
Queensware—Depreciates annually	10
Ribbons—Depreciate annually	25
Soap—Depreciate annually	5
Straw goods—Depreciate annually	50
Woolen and willow ware—Depreciate annually	15
Miscellaneous goods—Depreciate annually	20

Rolling Stock

Warwick, Mitchell and Company gave 20 years as the life of cars, including all equipment in the appraisal of a large street railway system.

In the *Milwaukee 3-Cent Fare Case* Professor M. E. Cooley gave 12.5 years, W. D. Pence gave 15 to 20 years, M. G. Starrett gave 16.7 years, as the life of cars, bodies, and trucks.

The Wisconsin Railroad Commission has accepted 15 years as the life of car bodies and equipment.

B. J. Arnold, in four Chicago appraisals, stated the life of electrical equipment as 3.3 to 4 to 8.5 years.

Stone and Webster in a Chicago traction case gave the life of electrical equipment as 11.75 to 15 years.

Henry Floy in the *Third Avenue Case* (New York) gave the life of trucks as 20 years.

The Traction Valuation Commission, Chicago Consolidated Traction Company, gave life of trucks as 30 years.

Warwick, Mitchell and Company in the appraisal of a large street railway system placed the life of utility equipment at 20 years.

For additional data see *Accountants' Index*, 1920 (pp. 583-88).

Saw Mills

The English Inland Revenue allows the following percentages on the reducing balance method:

	Annual Rate of Depreciation %
Engines, boilers, and main shafting	5
General saw-milling plant and machinery	7½
Traction engines, tractors, motor cars and haulage plant	20

R. H. Montgomery gives a general rate of 6 1/3%. (*Income Tax Procedure*, 1920, p. 724.)

H. S. Tiffany gives 3½% to 4½% for frame saw mills having steam power and 2½% to 4½% for those having water power.

The *Uniform Cost Sheet for Coal Mining Companies, Coal Age*, September 19, 1918 (pp. 545-47) gives 10% on original cost for saw mills.

Shipbuilding

The following data are from the table of rates of depreciation recommended by the committee on depreciation of the Atlantic Coast Shipbuilders' Association, December 11, 1918, in its *Cost Accounting and Shipbuilding* (pp. 48-50, 125-29):

Recommended that the straight-line method of charging off depreciation be adopted. That the normal rates of depreciation be increased to cover overtime depreciation, this increase being at a rate of 6¼% of the normal rate for each hour of overtime; all time in excess of the standard eight-hour day being considered overtime, in this connection. This rate of increase corresponds to 100% increase in normal rates when the plant is operated for the full 24 hours.

General Classification	Life in Years	Annual Rate Depr.	General Classification	Life in Years	Annual Rate Depr.
		%			%
BUILDINGS	25	4	BUILDINGS:		
			Stone, brick, concrete with or without steel frame and masonry curtain wall buildings	30	3⅓
			Steel with corrugated sheet iron or steel plate	20	5
			Steel or corrugated sheet iron with wood	15	6⅔
			Power plant buildings	20	5
			Wood buildings	10	10
			Piers, bulkheads, wharves and docks	20	5
			Launching ways (fixed structure) wood	10	10
			Concrete	13⅓	7½
			Water tanks and steel stacks	15	6⅔
			Drydocks, basin, masonry or concrete	40	2½
			Wood	25	4
			Concrete and brick bins, fences and miscellaneous concrete and brick structures	20	5
			Wood bins, fences, racks and other wood structures	5	20
MACHINERY AND TOOLS (including foundations)	15		POWER MACHINERY:		
			Electric generators, switchboards, and power house equipment: boilers and boiler house equipment, including economizers feed water heaters, injectors, stacks, uptakes, etc.	15	6⅔
			Engines, gas and oil	11¾	8½
			Engines, steam, including pile drivers, hoisting engines, compressors, air pumps, vacuum pumps, etc.	10	10

GENERAL CLASSIFICATION	Life in Years	Annual Rate Depr. %
Portable pneumatic, electric and hydraulic tools; portable hand, electric, hydraulic or pneumatic hoists and lifting devices; small jib cranes...	3	33⅓

GENERAL CLASSIFICATION	Life in Years	Annual Rate Depr. %
Pumps, water supply, feed water, fire, etc.	18	5½
Electric motors and controllers	11¾	8½
Coal and ash conveyors....	20	5
SHOP MACHINERY:		
Hydraulic forging presses, bending presses and fluid compressors	30	3⅓
Hammers, steam drop or helve	10	10
Machine tools, lathes, slotters, planers, boring mills, drilling, boring and milling machines	15	6⅔
Miscellaneous shop machinery and equipment, including small scales, spare parts, etc.	5	20
Woodworking machinery ..	20	5
Small tools	10	10
CRANES, ELEVATORS, ETC.:		
Cranes, electric, hydraulic, steam and hand power, jib and davit; hand, electric or air hoists, derricks, lifting magnets and charging machines	15	6⅔
Locomotive cranes, steam and electric	10	10
Elevators	20	5
Craneways	25	4
Portable pneumatic, electric and hydraulic tools; portable, hand, electric, hydraulic or pneumatic hoists and lifting devices; small jib cranes	3	33⅓
FURNACES AND FORGES:		
Heating, treating and annealing furnaces, brass foundry melting furnaces, oil furnaces, etc.	10	10
Blast, furnaces, stacks and stoves, soaking pits, open hearth and crucible melting furnaces, cupolas, etc.	25	4
Formers and drop forge dies	5	20

General Classification	Life in Years	Annual Rate Depr. %
Other Equipment (trackage, piping, wiring, etc.)	22	4½
Furniture and Fixtures	5	20

General Classification	Life in Years	Annual Rate Depr. %
Other Equipment:		
Railroad tracks, including rails, ties, ballast, excavation, grading, etc.	22	4½
Trestles, steel	25	4
Wood	15	6⅔
Bridge and retaining walls	33⅓	3
Marine railways	30	3⅓
Fire systems and apparatus	5	20
Piping and wiring; piping for steam and exhaust, air, oil, gas and water lines, pneumatic and hydraulic transmission, electric light and power systems, wiring, feeder and other outside wiring, including poles	16⅔	6
Heating and ventilating systems, drying apparatus	20	5
Sanitary and water supply systems, sewers and drainage systems	25	4
Floating equipment, barges, boats, scows, motor-boats	5	20
Portable launching ways	5	20
Floating drydocks	20	5
Stable and garage equipment	3	33⅓
Motor trucks and automobiles	3	33⅓
Locomotives, steam and electric	15	6⅔
Cars used by transportation department	10	10
Scales, large	10	10
Water purifier	15	6⅔
Pickling tanks, etc.	3	33⅓
Furniture and Fixtures:		
Office equipment, shop, yard, store and tool room fixtures, typewriters, adding machines, etc., lockers, wardrobes, etc.	5	20

Ships

The Federal Income Tax Department of Australia has allowed the following rates, reducing balance method. Repairs are allowed in addition.

	Annual Rate of Depreciation %
Launches	6
Ships	6
Steamers	6
Lugger	7½
Lighters—wooden, for conveyance of gaseous liquor	6
Coal	10
Constructed of iron or steel	6
Punts	6

J. D. S. Bogle gives the average life of steamers as about 20 years and considers 6% to 7% a fair rate of depreciation.

The following rates are provided by large companies:

P. and O. Company writes off 5%; also carries sums to suspense account.

Houlder, Ltd., under trust deed must provide 5%.

Cunard line provides nearly 5%.

Royal Mail S. P. Coy provides slightly more than 5%.

The Hamburg-American Company, during the period 1903-1913 allowed on an average of $4.11 per ton per annum for depreciation. For the same period the International Mercantile Marine Company made the inadequate average allowance of $2.35 per ton. (E. A. Saliers, in *Journal of Political Economy,* XXIII, p. 917.)

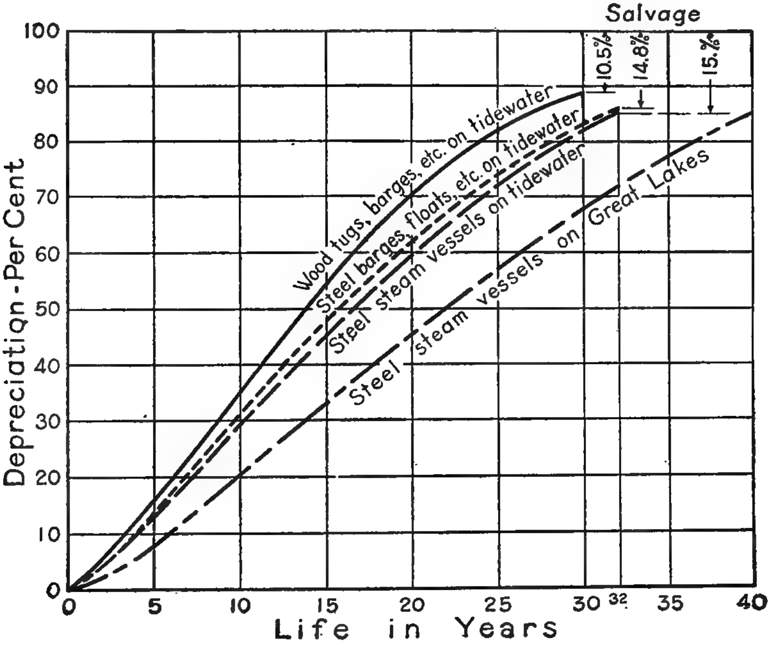
The Royal Mail Packet Company in 1914 allowed slightly more than 5% on first cost.

The White Star Line in 1914 allowed 4% on original first cost and betterments, a comparatively low allowance.

The diagram in Form 13 reproduced from Gillette and Dana's *Handbook of Mechanical and Electrical Cost Data,* shows the life and manner of depreciation of vessels on the Great Lakes and tidewater.

The English Inland Revenue allows as maximum rates 4% on the prime cost of steamships and 3% on the prime cost of sailing vessels. With regard to ships bought second hand at prices in excess of the written-down value at the date of purchase, the following arrangements have been made:

(a) The allowance is made on the actual cost price of the ship to the owner for the time being without regard to the prime cost to a previous owner.



Form 13. Chart Showing Rate of Depreciation of Vessels on the Great Lakes and Tidewater

(b) The rate of depreciation allowable is calculated by reference to the reasonable expectation of the life of the ship at the date of purchase from the previous owner.

During the war the United States Shipping Board allowed 10% for depreciation on an inflated valuation of commandeered vessels of approximately $175 per ton, which was more than twice their original cost.

At a conference between the president of the Ship Owners' Association of the Pacific Coast, professional accountants representing that association and officials of the Bureau of Internal Revenue, it was agreed that the proper annual rate of steam schooners engaged in the coastwise lumber trade is 5%, based upon an expected life of 20 years. (*Committee on Appeals and Review Memorandum* 279, 42-20-1245.)

Steam Plants

The following is from Nicholson and Rohrbach's *Cost Accounting:*

	Annual Rate of Depreciation %
Steam plant equipment:	
Steam power plant, including boilers and piping	6
Boilers	5
Boilers—including boiler house equipment, such as economizers, feed water heaters, injectors, damper regulators, etc. (does not include feed water pumps)	5½
Water purifying plant	5½
Engines	5
Steam turbines	5
Condensers	6
Piping	7½
Superheaters	5
Stokers—fixed parts	5
Stokers—moving parts	20

Telephone Companies

The following is from Barker's *Public Utility Rates* ([1917], p. 369):

TELELPHONE UTILITIES	Life in Years	Authority	Cause
Buildings	40	Chicago Tel. Comm.	O.
Cables:			
Lead-covered aerial	12	Wisconsin R. R. Comm.	D. & O.
Lead-covered under-ground	20	" " "	O. & D.
Central exchange equipment	10	" " "	O. & D.
Conduit	50	Chicago Tel. Comm.	O.
Cross arms	8–12	Wisconsin R. R. Comm.	D.
Furniture and tools	7	" " "	D.
Poles, wood in earth	12–15	" " "	D.
Power plant	8	" " "	D. & O.

Telephone Utilities	Life in Years	Authority	Cause
Private-branch exchange equipment	8	Chicago Tel. Comm.	D. & O.
Substations (subscribers')	10	Wisconsin R. R. Comm.	D. & O.
Wire:			
Copper, line	40	Chicago Tel. Comm.	O.
Copper, interior	30	" " "	O.
Galvanized iron, line	8–15	Wisconsin R. R. Comm.	D. & O.

Note that in some cases obsolescence is the controlling factor in the above table.

The following is from *Telephony,* April 1, 1911 (pp. 401-3): Estimated depreciation, schedule on an illustrative telephone plant:

	Annual Rate of Depreciation %
Poles and guys	6
Cable	2
Cable, messenger, hangers, labor, etc.	8
Cable terminals	7
Cross arms, hardware, insulators, pins, etc.	7
Line wire, copper	2
Drop wire and fastenings	8.5
Interior wire and fittings	8
Telephones and equipment	6
P. B. X. switchboards	7
Switchboards	7
Terminals, racks and machines	7
Batteries	18
Warehouse stock	3

For additional references and a very complete digest of public utility cases the reader should consult the *Accountants' Index,* pp. 622-634. The following may be noted:

In a Massachusetts telephone appraisal for rate purposes in 1909, 7.3% on the value of the property, exclusive of land, general supplies, and working capital (net current assets and cash on hand) was figured as the average yearly reconstruction cost. (Whitten, R. H., I, p. 433.)

In an Oklahoma telephone rate case in 1911, 7% on the reproduction value of physical property was regarded as a fair and sufficient allowance for depreciation. (Whitten, R. H., I, p. 434.)

In a Louisville, Ky., rate case in 1911, 7% on the depreciated property was allowed, on the theory "that the average life of the combined elements which make up the plant is about fourteen years."

The California Commission allowed 5.5%, but the base was not certain, probably original cost. (Whitten, R. H., II, pp. 1189-90.)

The Canada Board of Railway Commissioners allowed 6.77% on the book value of depreciable property in 1914.

In a Nebraska telephone case in 1914, $5.51 per subscriber's station was allowed. (Whitten, R. H., II, p. 1196.)

In an Oklahoma rate case 10 years was accepted as the life for inside equipment.

Transmission Lines

See data in Chapter V.

Turbines

The following is from Grunsky, *Valuation, Depreciation and the Rate Base* (p. 286):

	Life in Years	Authority
Turbines:		
Steam	15	St. Louis Public Service Commission. Case of Union Electric Light and Power Co.
“	20	Wisconsin Railroad Commission. Quoted by Henry Floy and in published reports.
“	20	Robt. Hammond. *Journal of the Institute of Electrical Engineers.* England, April 25, 1907.
“ (1c. lb. residual value)	30	Pacific Gas & Electric Co. Figures used in rate hearings before Master in Chancery, San Francisco, 1913-4.
Water	30	Wisconsin Railroad Commission. Quoted by Henry Floy and in published reports.
Water-type prior 1900	25–40	H. A. Foster. "Engineering Valuation of Public Utilities and Factories." Van Nostrand, 1912.

	Life in Years	Authority
Water-type after 1900	30–50	H. A. Foster. "Engineering Valuation of Public Utilities and Factories." Van Nostrand, 1912.
Steam	20	Milwaukee Electric Railway and Lighting Co., in Milwaukee 3-cent fare case, Aug., 1912.
"	15	St. Louis Public Service Commission. Case of Union Electric Light and Power Co.
"	20	Wisconsin Railroad Commission. Quoted by Henry Floy and in published reports.
"	20	Robt. Hammond. *Journal of the Institute of Electrical Engineers.* England, April 25, 1907.
" (1c. lb. residual value)	30	Pacific Gas & Electric Co. Figures used in rate hearings before Master in Chancery, San Francisco, 1913-4.
"	20	Stone & Webster. Figures for Chicago Union Traction Co. case.

Water Works

The following is from Barker's *Public Utility Rates:*

WATER WORKS	Life in Years	Authority	Cause
Buildings:			
Masonry	40–50	L. Metcalf	O.
Wood-frame	20–50	"	D.
Boilers:			
Fire-tube	12–16	"	D.
Water-tube	20–30	Wisconsin R. R. Comm.	D.
Filter beds	30–50	" " "	O.
Hydrants	40–50	L. Metcalf	D.
Mains:			
Large cast-iron (6-in. and over)	20–40	"	O.
Small cast-iron (4-in. and under)	50–75	"	O.
Steel	15–50	"	D.
Wood	30–50	Wisconsin R. R. Comm.	D.
Meters	20–30	L. Metcalf	D.
Pumps and engines	20–30	"	D.
Duplex	20–25	Wisconsin R. R. Comm.	D.
Triplex	20–30	" " "	D.
Crank and flywheel	30–40	" " "	O. & D.
Centrifugal	20–30	" " "	D.
Reservoirs	50–100	Wisconsin R. R. Comm. L. Metcalf	 O.
Standpipes	30–50	L. Metcalf	D.
Service pipes, lead	50–100	Wisconsin R. R. Comm.	D. & O.
Galvanized iron or steel	30–50	" " "	D.

Water Works	Life in Years	Authority	Cause
Suctions and intakes	30–50	Wisconsin R. R. Comm.	O. & D
Valves	40–50	L. Metcalf	D.
Wells, driven or drilled	50–75	Wisconsin R. R. Comm.	D.
Open and lines	75–100		O.

Note: D. denotes depreciation. O. denotes obsolescence.

The following is quoted from *Uniform Accounts for Systems of Water Supply,* Bureau of the Census:

> Until further study and experience or a series of inspections and appraisals at fixed intervals furnish more accurate data, the average life of the various parts of the fixed properties of a water-supply enterprise may be assumed to be approximately as follows: For horses, carriages, automobiles, and laboratory apparatus and appliances, 10 years; water meters, service pipes, office furniture, and general operating equipment, 15 years; boilers, steam pipes, and filtration equipment, 20 years; engines, pumping machinery, and wood pipes, 25 years; masonry of filtration plant, cribs, iron water pipes, intakes and connections, fire hydrants, standpipes, and buildings, 50 years; reservoirs, tunnels, and aqueducts, 100 years; and for the water-supply system as a whole, 50 years. All these approximations are subject to modification by reason of any unusual conditions which may shorten or prolong the life estimated above.

In the *Des Moines, Iowa, Water Rate Case* in 1910, an allowance of about 1% on the estimated present value of physical property subject to depreciation was granted. (Whitten, R. H., I, p. 428.)

In the *San Francisco Water Rate Case* in 1911, the district judge said:

> I find the annual depreciation of this plant to be 1 per cent. per annum for cast iron pipe, 2 per cent. for wrought iron pipe, 2.5 per cent. for pump engines, flumes and wooden structures, and 5 per cent. for boilers.

In Wisconsin, in 1912, 0.8% was allowed on reproduction cost new. (Whitten, R. H., II, p. 1203.)

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